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## INDEX TO VOLUME IV.

[The letters (O.A.) indicate an original article; (S.T.) indicate an article published in the section of "Surgical Technique"; (C.R.) indicate a case report.]

	PAGE.		PAGE.
<b>A</b>		<b>Brennan, A., Cultural Methods in the Diagnosis of Surgical Tuberculosis (O.A.)</b>	165
Abscess—		<b>Brown, A. E.</b>	81,
Of the Brain, by E. M. Atkinson (rev.)	331	86, 87, 89, 91, 197, 428, 430	
Subphrenic, by W. A. Hailes (O.A.)	3	<b>Brown, G., Post-Operative Pulmonary Complications (O.A.)</b>	260
<b>Acrocephalo-Syndactylism (Acrobrachy - Cephalo-Syndactylism), by M. P. Susman (C.R.)</b>	418	<b>Buchanan, J.</b>	85
<b>Actinomycosis</b>	327	<b>Burnell, G. H., Congenital Valvular Obstruction of the Posterior Urethra (C.R.)</b>	322
Of the Fallopian Tubes, by S. S. Gardiner (O.A.)	279	<b>Burns, Surface, The Treatment of, with Cod Liver Oil Salve</b>	86
<b>Adhesions, Pain Attributed to</b>	427		
<b>Anæsthesia—</b>		<b>C</b>	
"Percaïne", for Operations on the Stomach	329	<b>Calcareous Deposits in Supraspinatus Tendon and Subacromial Bursa, by F. F. Gwynne and D. Robb (O.A.)</b>	153
Rectal: "Avertin"	89	<b>Carcinoma of the Cervix Uteri—</b>	
Spinal, Quarella's Method of Inducing, with "Percaïne"	197	Radium Therapy of: Notes on the Immediate Results of Treatment, by E. Lynch (O.A.)	219
<b>Anatomy, Surgical, and Physiology, by N. C. Lake and C. J. Marshall (rev.)</b>	200	Surgical Excision of Pelvic Glands Supplementing Radiotherapy of	83
<b>Anus, Patulous, Plastic Repair of, by Means of Fascia Lata Strips, by E. Cato (S.T.)</b>	315	<b>Catgut—</b>	
<b>Arafa, M. A., and Hurst., Modern Aspects of Gastro-Enterology (rev.)</b>	437	Preparation of, for Surgical Use, by J. Smith, Junior (O.A.)	122
<b>Archibald, E. W.</b>	341	Sterilization of, by C. H. Kellaway and F. E. Williams (O.A.)	118
<b>Argyle, Stanley</b>	341	<b>Cato, E., Plastic Repair of Patulous Anus by Means of Fascia Lata Strips (S.T.)</b>	315
<b>Atkinson, E. M., Abscess of the Brain (rev.)</b>	331	<b>Chesky, V. E., and Hertzler, Surgery of a General Practice (rev.)</b>	436
<b>"Avertin", Rectal Anæsthesia</b>	89	<b>Chondroma of the Larynx, by R. Hennessy (C.R.)</b>	75
		<b>Clinical Science Incorporating Heart, edited by T. Lewis (rev.)</b>	94
<b>B</b>		<b>Cod Liver Oil—</b>	
<b>Baker Institute of Medical Research</b>	94	And Plaster Bandage Treatment of Wounds	85
<b>Balfour, Donald</b>	341	Salve, 'in Treatment of Surface Burns	86
<b>Barnett, L. E., Gaps in Our Knowledge of Hydatid Disease (O.A.)</b>	211	<b>Conwell, H. E., and Key, Fractures, Dislocations and Sprains (rev.)</b>	432
<b>Barrett, J., Entropion (S.T.)</b>	170	<b>Cross, K. S.—</b>	
<b>Begg, R. C., Renal Tuberculosis: The Problem of the Other Kidney (O.A.)</b>	30	Floating Gall-Stones (C.R.)	190
<b>Bell, F. G., Intracranial Pneumatocele (Pneumocephalus) Associated with an Orbito-Ethmoidal Osteoma (C.R.)</b>	70		
<b>Blood Transfusion</b>	428		
Conference on, at Leningrad	428		
<b>Bowel Resection, A Successful Case of Septuple, and Sextuple Anastomosis, by G. Gordon-Taylor (O.A.)</b>	345		

	PAGE.		PAGE.
Cross, K. S.— <i>Continued.</i>		Fitzgerald, H. W., Fracture of the	
Sinuses, Nasal Accessory, The		Capitellum (C.R.)	414
Rapidity with which Mucosal		Fracture of the Capitellum, by	
Changes Can Take Place in the		H. W. Fitzgerald (C.R.)	414
(C.R.)	424	Fractures—	
Cysts, Hamangioblastomatous, of		By P. B. Magnuson (rev.)	334
the Retina, by W. J. Hope-		Collum Femoris, Operative Treat-	
Robertson (O.A.)	55	ment of, by S. Johansson (rev.)	436
D		Dislocations and Sprains, by J. A.	
Dandy, W. E., Benign Tumours in		Key and H. E. Conwell (rev.)	432
the Third Ventricle of the		Of the Femoral Neck, Artificially	
Brain (rev.)	333	Produced, Smith-Petersen's Nail	87
Davis, C. H., Gynecology and		Of the Jaw, A Treatment of	87
Obstetrics (rev.)	201	Franklin, K. J., A Short History of	
D'Arcy, F. F.	199	Physiology (rev.)	335
Dévé, F., Intermediate and Transi-		G	
tional Pathological Forms		Gall-Stones, Floating, by K. S. Cross	
between Hydatid Echinococcus		(C.R.)	190
and Alveolar Echinococcus		Gardiner, S. S., Actinomycosis of	
(Bavaro-Tyrolienne) in Man		the Fallopian Tubes (O.A.)	279
(O.A.)	99	Gastro-Enterology, Modern Aspects	
Devine, H. B.	83,	of, by M. A. Arafa and A. F.	
87, 90, 92, 193, 208, 330, 331, 426,	432	Hurst (rev.)	437
Dew, H. R.	328	Gask, G. E., and Ross, Surgery of	
Dimmitt, P. S., Manual of Clinical		the Sympathetic Nervous	
Laboratory Methods (rev.)	433	System (rev.)	92
Dislocations, Fractures and Sprains,		Godard, H., and Leveuf	83
by J. A. Key and H. E. Conwell		Gordon-Taylor, G., Successful Case of	
(rev.)	432	Septuple Bowel Resection and	
Drainage, Suboccipital	81	Sextuple Anastomosis (O.A.)	345
Duodenal Fistula and Its Manage-		Grant, R. T.	94
ments, by V. Hurley (O.A.)	263	Gwynne, F. J., and Robb, Calcareous	
E		Deposits in Supraspinatus	
Earlam, M. S. S., Diverticula of the		Tendon and Subacromial Bursa	
Female Urethra (O.A.)	396	(O.A.)	153
Editorial—		Gynecology and Obstetrics, edited	
Actinomycosis	327	by C. H. Davis (rev.)	201
College Headquarters Building	191	H	
Library, A College	425	Hailes, W. A., Subphrenic Abscess	
System of Admission to Fellow-		(O.A.)	3
ship of the College	77	Hand, Infections of the, by A. B.	
Editorial Notices	96, 208, 336, 440	Kanavel (rev.)	199
Elliott, T. R.	94	Harris, S. H., Suprapubic Prosta-	
Entropion—		tectomy, with Closure (O.A.)	226
By J. W. Barnett (S.T.)	170	Hemiatrophy, Facial, by H. P.	
Cicatricial, and Trichiasis, Opera-		Pickerill (O.A.)	404
tions for the Relief of, by K.		Hempel, C.	90
O'Day (O.A.)	23	Hennessy, R.—	
Ewig, W.	430	Chondroma of the Larynx (C.R.)	70
F		Post-Operative Pulmonary Com-	
Fagge, C.	196	plications	260
Fischer, A. W.	427	Hertzler, A. E., and Chesky, Surgery	
Fistula—		of a General Practice (rev.)	436
Anal, The Treatment of, by R. D.		Hewer, E. E., An Introduction to	
Wright (S.T.)	169	the Study of the Nervous	
Sacral	330	System (rev.)	336

	PAGE.		PAGE.
Hope-Robertson, W. J., Hæmangioblastomatous Cysts of the Retina (O.A.) .....	55	Kidney, Congenital Solitary, by H. A. Phillips (C.R.) .....	186
Hore-Ruthven, Sir Alex., .....	202	Knee Joint, Pneumoradiography of the .....	91
Hughes-Jones, W. E. A., A Rare Anomaly of the Saphenous and Femoral Veins, with a Nævoid Condition in Certain Dermatomes (C.R.) .....	183	Kotrnitz, H. ....	87
Hunter, J. B., and Wakeley, Rose and Carless' Manual of Surgery (rev.) .....	434	Kulenkampff, D. ....	330
Hurley, V., Duodenal Fistula and its Management (O.A.) .....	263		
Hurst, A. F., and Arafat, Modern Aspects of Gastro-Enterology (rev.) .....	437	L	
Hydatid—		Laboratory Methods, Manual of Clinical, by P. S. Dimmitt (rev.) .....	433
Cyst of the Pancreas, by D. B. Walker (C.R.) .....	319	Laidlaw, P. P. ....	94
Disease, Gaps in Our Knowledge of: A Plea for Further Research, by L. E. Barnett (O.A.) .....	211	Lake, N. C., and Marshall, Surgical Anatomy and Physiology (rev.) .....	200
Echinococcus and Alveolar Echinococcus (Bavaro-Tyrolenne) in Man, Intermediate and Transitional Pathological Forms between, by F. Dévé (O.A.) .....	99	Lenormant, Ch., and Patel .....	81
		Leveuf, L., and Godard .....	83
I		Lewis, T. ....	94
Ileus, Continuous Drainage of the Stomach and Upper Bowel ..	90	Library, A College .....	425
Ipsen Johs. ....	87	Lindon, L. C. E., Ventriculography in the Diagnosis of Intracranial Tumour (O.A.) .....	271
Irvine, William .....	341	Lister, Lord, by C. J. S. Thompson (rev.) .....	200
		Löhr, W. ....	85, 86
J		Lynch, E., The Radium Therapy of Carcinoma of the Cervix Uteri: Notes on the Immediate Results of Treatment (O.A.) .....	219
Jenkins, J. A.—			
Intradural and Sacrococcygeal Tumour (C.R.) .....	63	M	
Safeguard for the Danger Area in the Rammstedt Operation for Congenital Hypertrophy of the Pylorus (S.T.) .....	318	Mackenzie, K., Developmental Anomalies of the Female Reproductive Organs, with Two Cases of Pseudo-Hermaphroditism (C.R.) .....	171
Johansson, S., The Operative Treatment of Collum Femoris Fractures (rev.) .....	436	Magnuson, P. B., Fractures (rev.) .....	334
		Marshall, C. J., and Lake, Surgical Anatomy and Physiology (rev.) .....	200
K		Mellanby, E. ....	94
Kadrnka, S., and Naz .....	194	Meniscus of the Knee Joint, Locked, Bloodless Release of .....	89
Kanavel, A. B., Infections of the Hand (rev.) .....	199	Miller, A., Modern Advances in Diseases of the Throat (rev.) .....	332
Kellaway, C. H.—		Miller, D. I. ....	208
And F. E. Williams, The Sterilization of Catgut (O.A.) .....	118	Monod, R. ....	89
Some Recent Studies on Intestinal Obstruction (O.A.) ..	384		
Key, J. A., and Conwell, Fractures, Dislocations and Sprains (rev.) ..	432	N	
		Naz, E., and Kadrnka .....	194
		Nervous System, An Introduction to the Study of the, by E. E. Hewer (rev.) .....	336
		Newland, H. S. ....	202, 340, 341
		Newton, A. ....	80
		Nielsen, A. ....	196
		O	
		Oberholzer, J. ....	91
		Obstetrics, Gynecology and, edited by C. H. Davis (rev.) .....	201

	PAGE.
Obstruction, Intestinal, Some Recent Studies on, by C. H. Kellaway (O.A.)	384
O'Day, K., Operations for the Relief of Trichiasis and Cicatricial Entropion (O.A.)	23
Ophthalmology, A Short History of, by A. Sorsby (rev.)	335
Osteochondritis Capiti Humeri	196
Osteitis Fibrosa, Generalized, with Parathyroid Adenoma, by K. Ross (C.R.)	407
P	
Pain Attributed to Adhesions	427
Parathyroid Adenoma, Generalized Osteitis Fibrosa with, by K. Ross (C.R.)	407
Patel, J., and Lenormant	81
"Percaïne"—	
Anæsthesia for Operations on the Stomach	329
In Spinal Anæsthesia, Quarella's Method	197
Phillipowicz, I.	329
Phillips, G., Radiography in the Diagnosis of Intracranial Tumours (O.A.)	30
Phillips, H. A., Congenital Solitary Kidney (C.R.)	186
Physiology—	
Short History of, by K. J. Franklin (rev.)	335
Surgical Anatomy and, by N. C. Lake and C. J. Marshall (rev.)	200
Pickerill, H. P., Facial Hemiatrophy (O.A.)	404
Pneumatocele, Intracranial (Pneumocephalus), Associated with an Orbito-Ethmoidal Osteoma, by F. G. Bell (C.R.)	70
Pneumoradiography of the Knee Joint	91
Post-Operative Circulatory Conditions	430
Power, D'Arcy	341
How Surgery Came to Australasia (O.A.)	368
Short History of Surgery (rev.)	93
Prostatectomy, Suprapubic, with Closure, by S. H. Harris (O.A.)	226
Prostatic Obstruction, The Surgery of, by E. R. Reay (O.A.)	130
Pulmonary Complications, Post-Operative—	
By G. Brown (O.A.)	256
By R. Hennessy (O.A.)	260
By H. H. Turnbull (O.A.)	245
Q	
Quarella, B.	197

	PAGE.
R	
Rammstedt Operation for Congenital Hypertrophy of the Pylorus, A Safeguard for the Danger Area in the, by J. A. Jenkins (S.T.)	318
Reay, E. R., The Surgery of Prostatic Obstruction (O.A.)	130
Reproductive Organs, Developmental Anomalies of the, with Two Cases of Pseudo-Hermaphroditism, by K. Mackenzie (C.R.)	171
Respiration, The Physiology and Pathology of, in Relation to Surgery	81
Reviews—	
Abscess of the Brain: Its Pathology, Diagnosis and Treatment, by E. M. Atkinson	331
Benign Tumours of the Third Ventricle of the Brain: Diagnosis and Treatment, by W. E. Dandy	333
Clinical Science Incorporating Heart, edited by T. Lewis	94
Fractures, by P. B. Magnuson	334
Fractures, Sprains and Dislocations, by J. A. Key and H. E. Conwell	432
Gynecology and Obstetrics, edited by C. H. Davis	201
Infections of the Hand, by A. B. Kanavel	199
Introduction to the Study of the Nervous System, by E. E. Hewer	336
Lord Lister, by C. T. S. Thompson	200
Manual of Clinical Laboratory Methods, by P. S. Dimmitt	433
Modern Advances in Diseases of the Throat, by A. Miller	332
Modern Aspects of Gastro-Enterology, by M. A. Arafat and A. F. Hurst	437
Monograph of the Baker Institute of Medical Research. Number 2: The Spread of Tumours in the Human Body, by R. A. Willis	94
Operative Treatment of Collum Femoris Fractures, by S. Johansson	436
Rose and Carless' Manual of Surgery for Students and Practitioners, by C. P. Wakeley and J. B. Hunter	434
Short History of Ophthalmology, by A. Sorsby	335

	PAGE.		PAGE.
Reviews—Continued.		<b>S</b>	
Short History of Physiology, by K. J. Franklin .....	335	Schede, Fr. ....	330
Short History of Surgery, by D'Arcy Power .....	93	Seifert, E. ....	89
Surgery of a General Practice, by A. E. Hertzler and V. E. Chesky .....	436	Sinus, Nasal Accessory, The Rapidly with which Mucosal Changes Can Take Place in the, by K. S. Cross (C.R.) .....	424
Surgery of the Sympathetic Nervous System, by G. E. Gask and J. P. Ross .....	92	Smith, J., Junior, The Preparation of Catgut for Surgical Use (O.A.) .....	122
Surgical Anatomy and Physiology, by N. C. Lake and C. J. Marshall .....	200	Smith-Petersen's Nail in Fractures of the Femoral Neck .....	87
Robb, D., and Gwynne, Calcareous Deposits in Supraspinatus Tendon and Subacromial Bursa (O.A.) .....	153	Sorsby, A., A Short History of Ophthalmology (rev.) .....	335
Ross, J. P., and Gask, Surgery of the Sympathetic Nervous System (rev.) .....	92	Sprains, Fractures, Dislocations and, by J. A. Key and H. E. Conwell (rev.) .....	432
Ross, K., Generalized Osteitis Fibrosa, with Parathyroid Adenoma (C.R.) .....	407	Stomach, Radiological Examination of, by Study of its Mucosal Folds .....	194
Royal Australasian College of Surgeons—		Strain on the Abdominal Wall of a Patient in the Dorsal Position, Post-Operative Relief of the ..	330
Annual Meeting, 1934 .....	202	Surgery—	
Council Report .....	203	History of, A Short, by D'Arcy Power (rev.) .....	93
Annual General Meeting, 1935 .....	206	How it Came to Australasia, by D'Arcy Power (O.A.) .....	368
Birthday Honours .....	207	In Other Countries—	
Censors, Boards of .....	204	Blood Transfusion .....	428
Council Election .....	203	Burns, The Treatment of Sur- face, with Cod Liver Oil Salve ..	86
Deaths of Fellows .....	203	Carcinoma of the Cervix Uteri, The Surgical Excision of Pelvic Glands Supplementing Radiotherapy of .....	83
Headquarters, Permanent ..	205	Cod Liver Oil and Plaster Bandage Treatment of Wounds of the Hand and Foot without Loss of Sub- stance .....	85
Librarian's Report .....	206	Fractured Jaw, A Treatment of .....	87
Post-Graduate Hospital in Melbourne .....	205	Ileus, Continuous Drainage of the Stomach and Upper Bowel in .....	90
Primary Fellowship Examina- tion .....	205	Meniscus of the Knee Joint, Locked, Bloodless Release of ..	89
Surgical Assistants at Clini- cal Schools .....	205	Osteochondritis Capitulii Humeri ..	196
Vacancies Caused by Death of Censor-in-Chief .....	203	Pain Attributed to Adhesions ..	427
Vice-President, Resignation of .....	203	"Percaïne" Anæsthesia for Operations on the Stomach ..	329
Editorial Committee Report ..	207	Pneumoradiography of the Knee Joint, The Technique of, after Birchler .....	91
Election of Fellows .....	202	Post-Operative Circulatory Con- ditions .....	430
Journal Report .....	207		
Annual Meeting, 1935 .....	439		
Election of Fellows .....	440		
Election of Office-Bearers .....	439		
Election of President .....	439		
Honorary Fellowships .....	341		
College Headquarters Building ..	191		
Opening Ceremony .....	340		
Greetings from Overseas ..	341		
Message from His Majesty the King .....	339		
Fellowship of the College, The System of Admission to .....	77		

Surgery—Continued.	PAGE.	Tumour—Continued.	PAGE.
In Other Countries—Continued.		Intradural and Sacrococcygeal, by J. A. Jenkins (C.R.) .....	63
Quarella's Method of Inducing Spinal Anæsthesia with "Percaine" .....	197	Benign, in the Third Ventricle of the Brain, by W. E. Dandy (rev.) .....	333
Rectal Anæsthesia: "Avertin" ..	89	Intracranial, Radiography in the Diagnosis of, by G. Phillips (O.A.) .....	30
Respiration, Observations on the Physiology and Pathology of, in Relation to Surgery ..	81	Spread of, in the Human Body, by R. A. Willis (rev.) .....	94
Sacral Fistula .....	330	Turnbull, H. H., Post-Operative Pulmonary Complications (O.A.)	245
Smith-Petersen's Nail, Investi- gations Regarding Firmness of the Osteo-Synthesis Ob- tained with, in Artificially Produced Mesial Fractures of the Femoral Neck .....	87		
Stomach, Radiological Examina- tion of, by the Study of its Mucosal Folds .....	194	U	
Strain on the Abdominal Wall of a Patient in the Dorsal Position, Post-Operative Relief of the .....	330	Congenital Valvular Obstruction of the Posterior, by G. H. Burnell (C.R.) .....	322
Suboccipital Drainage .....	81	Diverticula of the Female, by M. S. S. Earlam (O.A.) .....	396
International Society of, Ninth Congress of the .....	89	V	
Of a General Practice, by A. E. Hertzler and V. E. Chesky (rev.) .....	436	Veins, A Rare Anomaly of the Saphenous and Femoral, with a Nævoid Condition in Certain Dermatomes, by W. E. A. Hughes-Jones (C.R.) .....	183
Of the Sympathetic Nervous System, by G. E. Gask and J. P. Ross (rev.) .....	92	Ventriculography in the Diagnosis of Intracranial Tumour, by L. C. E. Lindon (O.A.) .....	271
Rose and Carless' Manual of, by C. P. Wakeley and J. B. Hunter (rev.) .....	434	Verney, E. B. ....	94
Susman, M. P., Acrocephalo- Syndactylism (Acrobrachy- Cephalo-Syndactylism) (C.R.)	418		
		W	
T		Wade, Henry .....	341
Takács, Z. ....	81	Wade, R. B. ....	439
Thompson, C. J. S., Lord Lister (rev.) .....	200	Wakeley, C. P., and Hunter, Rose and Carless' Manual of Surgery (rev.) .....	434
Throat, Modern Advances in Dis- eases of the, by A. Miller (rev.)	332	Walker, D. B., Hydatid Cyst of the Pancreas (C.R.) .....	319
Transfusion, Blood .....	428	Waring, Holburt .....	340, 341
Trichiasis and Cicatricial Entropion, Operations for the Relief of, by K. O'Day (O.A.) .....	23	Williams, F. E., and Kellaway, The Sterilization of Catgut (O.A.)	118
Trotter, W. ....	94	Willis, R. A., The Spread of Tumours in the Human Body (rev.) .....	94
Tuberculosis—		Wounds of the Hand and Foot without Loss of Substance, Cod Liver Oil and Plaster Bandage Treatment of .....	85
Cultural Methods in the Diagnosis of Surgical, by A. Brennan (O.A.) .....	165	Wright, R. D., The Treatment of Anal Fistula (S.T.) .....	169
Renal: The Problem of the Other Kidney, by R. C. Begg (O.A.)	30		
Tumour—		Z	
Intracranial, Ventriculography in the Diagnosis of, by L. C. E. Lindon (O.A.) .....	271	Zwar, B. T. ....	89, 330

# The Australian and New Zealand Journal of Surgery

JULY, 1934.

## TABLE OF CONTENTS.

[The Whole of the Literary Matter in THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY is Copyright.]

### ORIGINAL ARTICLES—

	PAGE.
SUBPHRENIC ABSCESS .....	W. A. Hailes 3
OPERATIONS FOR THE RELIEF OF TRICHIASIS AND CICATRICAL ENTROPION .....	Kevin O'Day 23
RADIOGRAPHY IN THE DIAGNOSIS OF INTRACRANIAL TUMOURS .....	Gilbert Phillips 30
RENAL TUBERCULOSIS: THE PROBLEM OF THE OTHER KIDNEY .....	R. Campbell Begg 50
HÆMANGIOBLASTOMATOUS CYSTS OF THE RETINA ....	W. J. Hope-Robertson 55

### CASE REPORTS—

AN INTRADURAL AND SACROCOCCYGEAL TUMOUR .....	James A. Jenkins 63
INTRACRANIAL PNEUMATOCELE (PNEUMOCEPHALUS) ASSOCIATED WITH AN ORBITO-ETHMOIDAL ONTEOMA .....	F. Gordon Bell 70
A CHONDROMA OF THE LARYNX .....	Raymond Hennessy 75

### EDITORIAL—

THE SYSTEM OF ADMISSION TO FELLOWSHIP OF THE COLLEGE .....	77
--	----

### SURGERY IN OTHER COUNTRIES—

OBSERVATIONS ON THE PHYSIOLOGY OF RESPIRATION IN RELATION TO SURGERY .....	81
SUBOCCIPITAL DRAINAGE .....	81
THE SURGICAL EXCISION OF PELVIC GLANDS SUPPLEMENTING RADIOTHERAPY OF CARCINOMA OF THE CERVIX UTERI .....	83
COD LIVER OIL AND PLASTER BANDAGE TREATMENT OF WOUNDS OF THE HAND AND FOOT WITHOUT LOSS OF SUBSTANCE .....	85
THE TREATMENT OF SURFACE BURNS WITH COD LIVER OIL SALVE .....	86
A TREATMENT OF FRACTURED JAW .....	87
INVESTIGATIONS REGARDING THE FIRMNESS OF THE OSTEO-SYNTHESIS OBTAINED WITH THE AID OF SMITH-PETERSEN'S NAIL CARRIED OUT ON ARTIFICIALLY PRODUCED MESIAL FRACTURES OF THE FEMORAL NECK .....	87
BLOODLESS RELEASE OF LOCKED MENISCUS OF THE KNEE JOINT .....	89
RECTAL ANÆSTHESIA: "AVERTIN" .....	89
CONTINUOUS DRAINAGE OF THE STOMACH AND UPPER BOWEL IN ILEUS ....	90
THE TECHNIQUE OF PNEUMORADIOGRAPHY OF THE KNEE JOINT AFTER BIRCHER .....	91

### REVIEWS—

THE SYMPATHETIC SYSTEM .....	92
SURGERY IN HISTORY .....	93
TUMOURS AND THEIR SPREAD .....	94
CLINICAL SCIENCE .....	94

EDITORIAL NOTICES .....	96
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## SUBPHRENIC ABSCESS.

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*Melbourne.*

### ANATOMY.

SINCE Barnard<sup>(1)</sup> has given a masterly description of the spaces under the diaphragm, there is no need to dwell at length on their anatomy. Everyone should be familiar with the boundaries of the right anterior and right posterior intraperitoneal spaces, of the left anterior and left posterior intraperitoneal spaces, and of the right and left extraperitoneal spaces. In view, however, of the relative frequency of abscesses in the right posterior intraperitoneal space in the small series herein to be described, it does seem pertinent to consider the boundaries of this space and its relationship to the inferior and dorsal surfaces of the right lobe of the liver. Barnard in his article analysed 76 subphrenic abscesses; and while it must be admitted that abscesses in the right posterior intraperitoneal space did not predominate in that series, it must be remembered that his article was published in 1908 before the universal application of Fowler's position in the pre-operative and post-operative nursing of patients suffering from acute abdominal conditions. In fact, Barnard makes a plea for the use of Fowler's position which is now general.

The bare area of the liver, the right extraperitoneal subphrenic space, intervenes between the right anterior and right posterior intraperitoneal subphrenic spaces; and as the bare area is outlined by the upper and lower layers of the coronary ligament, it is essential to consider first just where the reflections of the coronary ligament on the liver occur. The reflection of the upper layer of the right portion of the coronary ligament is at the junction of the superior and dorsal aspects of the right lobe, the reflection of the lower layer of the right portion of the coronary ligament transects the junction of the dorsal and inferior surfaces. This means that the right posterior subphrenic space is chiefly related to the inferior surface of the right lobe, except for a small area to the right of the inferior layer of the ligament after it has crossed the boundary between the posterior and inferior surfaces (Figure 1). No portion of the right posterior intraperitoneal space encroaches on the superior surface, and the bare area forms the greater part of the dorsal surface of the right lobe. The reflection of the inferior

layer is from the inferior and dorsal surfaces of the liver to the upper pole of the right kidney; the limits of the right anterior space to the right are arbitrary, depending on how far it is projected around the base of the liver; in infection it is limited always by the formation of adhesions.

It will be seen from the above that the right posterior intraperitoneal space is really the hepato-renal recess and the prolongation of that space to the right below the reflection of the inferior layer of the coronary ligament. Further, while the latter portion of this space is directed almost vertically, the hepato-renal recess lies in a plane angled considerably nearer to the horizontal than to the vertical (Figures I and II). Herein is the explanation of the difficulty sometimes experienced in locating right posterior abscesses with an exploring syringe. If the abscess is confined to the hepato-renal region, the needle entered between

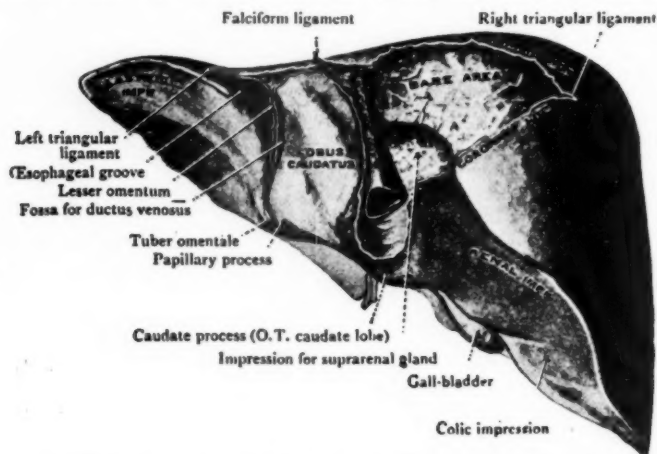


FIGURE I. Posterior surface of the liver. (From Cunningham's "Practical Anatomy".)

the ribs does not approach the abscess at right angles to its long axis, but nearly parallel to its smallest dimension. If the abscess is encroaching on that portion of the space related to the dorsal surface of the liver (Figure I), it will be readily located with a needle. Moreover, it is easy to see why these abscesses tend, as is so often said, to loculate or to drain incompletely. It is possible to drain easily the portion of the abscess that encroaches on the dorsal surface lying between the liver and diaphragm (Figure I) and not to attain adequate drainage for the portion around the corner in the hepato-renal recess and *vice versa*. This is all very well shown in the model copied from Cunningham's "Practical Anatomy" (Figure II); and the same model taken in conjunction with the picture of the dissection of the thorax, right side (Figure III), also from Cunningham, indicates the anatomy of the

surgical approach both to this space and also to a suppurating hydatid cyst of the upper surface of the right lobe of the liver, which so often encroaches on the bare area and which is the most common cause of suppuration in the right posterior extraperitoneal space in this country. The approach to the first must be low down and far back if the dorsal route is to be used. It must be low down to avoid the relatively wide posterior portion of the phrenicocostal sinus situated at a higher level; the narrower this is, the greater is the probability of its obliteration by elevation of the diaphragm and adhesions. The approach must be far back because the abscess is situated fairly close to the vertebral bodies as shown in Figure IV. This figure also clearly indicates where the

first exploratory punctures should be made. On the other hand, the approach to a suppurating hydatid cyst encroaching on the bare area, that is, the right extraperitoneal space, should be as a rule much farther forward and higher up. It should be higher up because, in coming to the surface at the bare area, the space has enlarged upwards and forwards; it should be forwards also because the phrenicocostal sinus is narrower ventrally and therefore the diaphragm and liver

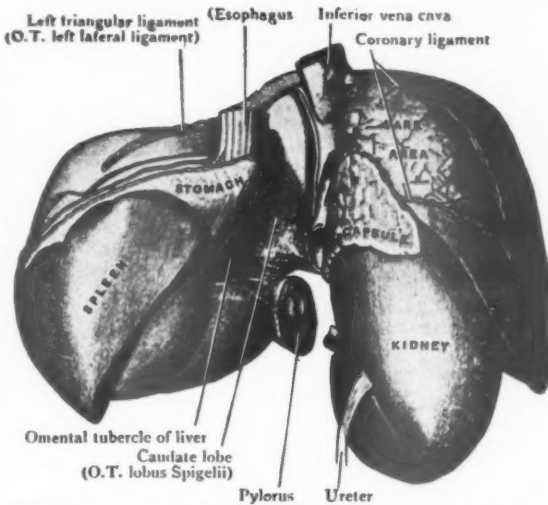


FIGURE II. Liver, right kidney, spleen and stomach, as seen from behind. Drawing made from a model prepared by the reconstruction method. (From Cunningham's "Practical Anatomy".)

are easier to approach. In the two pictures, the inferior *vena cava* is a convenient landmark, as one is a posterior and the other a lateral view.

There is little need to refer to the anatomy of the left sided spaces, the left posterior and left anterior as outlined by the omental bursa on the one hand and the subdiaphragmatic area anterior to it on the other (Figure V). The left extraperitoneal space is regarded by many as really perinephric. There is still anatomically another space on the left side. Intraperitoneal and not included in any of those already mentioned, it is situated around the spleen and between the spleen, left kidney and diaphragm (Figure VI). It has not been named specifically, probably because suppuration in this area from extension from local pathological conditions or from inflammatory foci at a distance is of rare occurrence.

The falciform ligament prevents suppuration under the right half of the diaphragm from spreading to the area under the left half, and *vice versa*; and while the omental bursa is closed except for the foramen of Winslow from the rest of the peritoneal cavity, the right anterior and right posterior intraperitoneal spaces communicate directly around the right lateral surface of the liver and around the inferior surface of the right lobe.

#### ÆTIOLOGY.

Any inflammatory condition, injury to or perforation of any viscus bordering on any of the recognized spaces can cause suppuration in

that space. This is especially true with disease of the gall-bladder, stomach and duodenum, and pancreas. Subphrenic abscesses also arise by spread of infection from a distance. This happens especially in appendicitis, when the infection commonly travels along the outer side of the colon, either from an appendix situated extracaeally, or from a pelvic appendix in which the pus has filled the pelvis and has spread along the paracolic gutter to the hepatorenal recess, or has in some cases even spread along the outer side of the descending colon to the area under the left half of the diaphragm.

Subphrenic abscesses develop also, especially on the right side, as a complication of a general infection or soiling of the peritoneal cavity that responds in the main to suitable surgical treatment, only

to be followed by the development of an abscess in one of those areas in which adequate drainage is difficult to attain and can be attempted only by the adoption of the Fowler position.

It is usually taught that suppuration or inflammatory conditions in the neighbourhood of the foramen of Winslow result in adhesions occluding the foramen, with the result that inflammatory collections tend to be limited to either the general peritoneal cavity or the omental

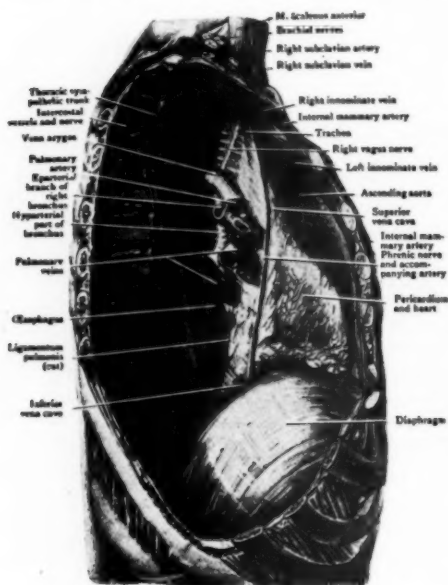


FIGURE III. The right pleural chamber opened up by the removal of its lateral wall. The lung has been taken away so as to expose the mediastinal wall of the pleural chamber. (From Cunningham's "Practical Anatomy".)

bursa. While this is true of inflammatory lesions, it does not apply to ulceration of the posterior wall of the stomach, which perforates instead of, as is usually the case, penetrating the posterior abdominal wall. In two such cases operated on at the Melbourne Hospital the omental bursa and general peritoneal cavity were full of fluid, and the fluid could be seen freely flowing through the foramen. In one case the ulcer was close to the pylorus; in the other it was high up on the posterior surface. In the first case the patient recovered; the second patient died of pulmonary complications several days after operation. In each

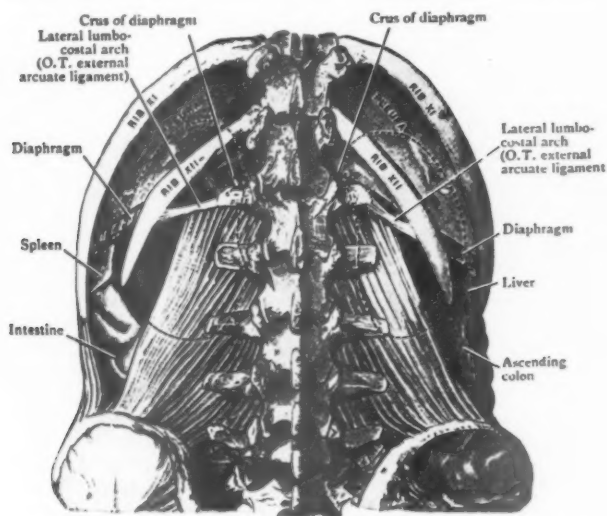


FIGURE IV. Dissection from behind to show the relation of the two pleural sacs to the kidneys. Outline of upper portions of kidneys indicated by dotted lines. (From Cunningham's "Practical Anatomy".)

instance both cavities were drained. These are, of course, not considered to be cases of subphrenic abscess, but are cited to show that occlusion of the foramen depends on the mode of onset of the lesion in its neighbourhood.

#### SPREAD.

The natural spread of the inflammatory condition well walled off in the abdomen is through the thin diaphragm, with the development of some slight degree of pleural effusion often to be followed by an empyema or pyo-pneumothorax. Subphrenic abscesses secondary to empyema are recorded. I have not seen such a case; and while it is easy to imagine that an abscess could occur on the left side, it is difficult to visualize such an occurrence on the right, where the inflammatory reaction, if it

spread through, would surely result in the peritoneal surfaces of liver and diaphragm becoming adherent. Reading the reports of some of the reported cases prompts the suggestion that the complicating empyema was treated before the initiating intraabdominal lesion. Schwartz<sup>(2)</sup> expresses a similar opinion and says he has never seen a case secondary to an empyema.

Abscesses may point and be evacuated spontaneously through bowel or bronchus. We still see anteriorly, arising from right and left anterior intraperitoneal spaces, abscesses which have reached the stage of pointing

either on the right or left side of a line running from the umbilicus to the xiphisternum. Except in the case of a suppurating hydatid, such abscesses surely should nowadays never reach the stage of spontaneous evacuation through a bronchus or the intestinal tract.

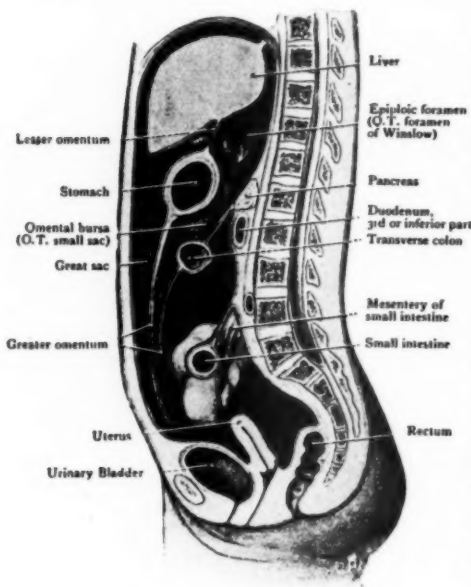


FIGURE V. Sagittal section of abdomen. (From Cunningham's "Practical Anatomy".)

transient, the development slow and the virulence of low degree. While in this type of case the signs and symptoms are the same as those of the more acute type, the prognosis is much more favourable as a rule, or at least it has been so in my experience.

The majority of the patients cited were treated by me at the Melbourne Hospital; the other cases occurred in private practice.

CASE I.—E.F., a female, aged twenty-six years, was admitted to Melbourne Hospital on May 23, 1920. Three days prior to admission the illness began with severe diffuse lower pain of a type previously experienced and vomiting of bile. There had been scalding micturition, a temperature 37.9° C. (100.2° F.) and a pulse rate of 144.

#### OBSERVED CASES.

This paper is based on acute subphrenic abscesses arising as a complication of acute abdominal conditions or following operative intervention in the upper part of the abdomen. I have purposely excluded all suppurating hydatid cysts on the upper surface of the liver. I have also excluded the more chronic type of subphrenic abscess, no doubt secondary to some inflammatory lesion in the abdomen, of which the symptoms have been mild or

On admission the patient was regarded as suffering from salpingitis, but when I saw her first on May 26, 1920, her temperature was  $38.3^{\circ}\text{C}$ . ( $101^{\circ}\text{F}$ .) and her pulse rate 144. The abdomen was distended, tender and rigid, especially in the lower areas, but these signs were more pronounced over McBurney's point. On vaginal examination tenderness was discovered in the fornices; no mass was palpable. A diagnosis of appendicitis with pelvic peritonitis was made. At immediate operation a pelvic appendix was removed, pus was evacuated from the pelvis, and the pus could then be seen tracking along the outer side of colon and caecum; a drain was inserted in the pelvis and loin.

On May 30, 1920, the temperature was still  $38.3^{\circ}\text{C}$ . ( $101^{\circ}\text{F}$ .). Dulness was present at the base of the right lung. Vocal resonance and vocal fremitus were diminished at the right base. Neither cough nor sputum was present.

On June 2, 1920, the right pleura was aspirated, a little straw coloured fluid being found.

On June 4, 1920, dulness extended to the angle of the right scapula; the pleura was explored, but no fluid was obtained.

On June 8, 1920, the radiologist reported that the diaphragm was pushed up and immobile. He thought that probably a subphrenic abscess was present.

On June 12, 1920, under general anaesthesia, the right side of the chest was explored. A little straw coloured fluid was found in the pleural cavity, but when the needle was pushed through the diaphragm in the tenth interspace in the scapular line pus was found. When the syringe and the needle were disconnected, the needle oscillated with the diaphragm, showing the abscess to be subphrenic. In a one-stage operation pus was evacuated and drainage was established. The patient's condition progressively improved till she was out of bed.

On July 6, 1920, her temperature and pulse rate were elevated again and dulness was noted at the right base, with diminished breath sounds, vocal resonance and vocal fremitus. A localized area of tympany was found in the dull area. There was also cough with foul breath and foul sputum. The condition was obviously a pyo-pneumothorax. The pleural cavity was opened and drained, and the patient was discharged quite well on August 4, 1920. She is still well, except for a ventral hernia.

This case was regarded as a right posterior intraperitoneal subphrenic abscess and is reported in detail, as it is a typical example

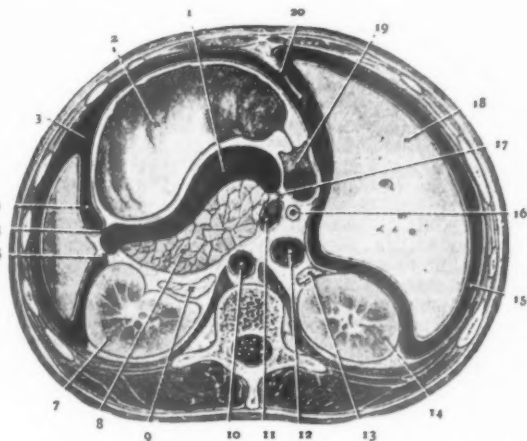


FIGURE VI. Transverse section of abdomen immediately below the epiploic foramen: 1 = omental bursa (O.T. small sac); 2 = stomach; 3 = great sac; 4 = great sac; 5 = gastro-splenic ligament (O.T. gastro-splenic omentum); 6 = lienorenal ligament; 7 = left kidney; 8 = pancreas; 9 = left suprarenal gland; 10 = aorta; 11 = portal vein; 12 = inferior vena cava; 13 = right suprarenal gland; 14 = right kidney; 15 = great sac; 16 = bile duct; 17 = gastro-duodenal artery; 18 = liver, 19 = duodenum, first part; 20 = falciform ligament. (From Cunningham's "Practical Anatomy".)

of onset and method of spread, and the patient presented the classical signs and symptoms.

CASE II.—A.E., a male, aged twenty-four years, was admitted to Melbourne Hospital on July 21, 1920. He was quite well till three weeks previously, when he noticed pain in the right side; the pain was not severe at first, but steadily became worse. He complained of loss of appetite, and had a palpable mass in right side of the lower part of the abdomen for ten days. He had been in bed for ten days. His temperature was  $38.3^{\circ}$  C. ( $101^{\circ}$  F.) and his pulse rate was 104. On examination no abnormality was detected except in the abdomen. The liver was not enlarged either upwards or downwards. There was a large and tender mass in the right lumbar region, not extending into the costo-vertebral angle and not connected with the liver. The maximum tenderness was over the lower portion in the neighbourhood of McBurney's point. A diagnosis of appendiceal abscess was made. The abscess was opened and drained, and as it was not seen, the appendix was not removed.

On July 27, 1920, dulness extended high up in the axilla, with diminished breath sounds, vocal resonance and vocal fremitus. There was little cough or sputum. Tenderness was also present at the costal margin. It was thought that a right anterior subphrenic abscess was present. The radiologist reported that the diaphragm was pushed up a little on both sides, but not unduly. The lungs were clear, the abdomen was distended, but the bowels were acting. Leucocytes numbered 13,000 per cubic millimetre.

On July 30, 1920, the base of the right lung and the subphrenic region were explored with a needle. I was so certain that pus was present that, when I was unable to find it, I explored the subphrenic space posteriorly by rib resection and suturing of the diaphragm to the thoracic wall. An opening was made and still no pus was found. The wound was closed. The abdominal wound broke down, the bowel protruded and the patient developed a faecal fistula; his abdomen was always more or less distended. He had a temperature up to  $37.8^{\circ}$  C. ( $100^{\circ}$  F.) and a pulse rate of 110. He then developed a hard tender oedematous mass midway between the mid-line and the right costal margin. Under local anaesthesia a large right anterior subphrenic abscess was opened and drained through the indurated area. The patient quickly recovered.

This case is reported in detail because as a result of additional experience I believe that if no pus is found in the posterior portion of the right anterior space and in the right posterior subphrenic space on aspiration, when the surgeon is confident of the diagnosis of pus in the upper part of the abdomen, the correct procedure is laparotomy, not transthoracic exploration of the subphrenic region, as the area thus explored is too limited. It is not held, as some writers have held recently, that laparotomy is indicated in all cases. The correct procedure is to localize the abscess and to evacuate it by as direct a route as possible and with a minimum of shock and trauma, for the patients are often very ill indeed. The pointing of the abscess showed clearly that when exploratory puncture failed, laparotomy would have succeeded.

CASE III.—A.C., a male, aged thirty-six years, was admitted to the Melbourne Hospital on June 9, 1922. He had a perforated duodenal ulcer of six hours' duration; the perforation was sutured and the pelvis was drained. He developed signs at the bases of both lungs and the temperature remained between  $37.8^{\circ}$  and  $38.3^{\circ}$  C. ( $100^{\circ}$  and  $101^{\circ}$  F.). On July 7, 1922, an abscess around the spleen was evacuated across the left pleura after localization by aspiration. He was discharged in two weeks, to be readmitted on August 12, 1922, with definite signs of right posterior subphrenic abscess confirmed by X ray examination. The abscess was evacuated by the transpleural route in one stage on August 14, 1922.

This patient subsequently developed a right sided empyema, but was subsequently discharged with the wound healed.

CASE IV.—C.C., a male, aged thirty-four years, was admitted to the Melbourne Hospital on January 5, 1924. Three days after admission he had an appendiceal attack which persisted, and on admission his temperature was 38.3° C. (101° F.) and his pulse rate 130. The lower part of his abdomen was tender and rigid; the tenderness was more pronounced on the right side. Immediate appendicectomy for gangrenous perforated appendix was performed; two tubes were inserted, one to the pelvis and one in the right iliac fossa. The patient's temperature was normal after three days and remained normal for seven days. He then had a rigor, with a temperature of 40° C. (104° F.). This subsided, but there was dulness with diminished vesicular murmur, vocal resonance and vocal fremitus, and the voice sounds had a nasal tone. He went at his own risk on the twenty-third day, and was admitted again three days later with a temperature of 39.4° C. (103° F.) and a pulse rate of 132, and he looked very ill. Dulness was present at the base of the right lung to the sixth rib in the posterior axillary line; liver dulness extended one finger's breadth below the costal margin. The appendiceal wound was almost healed; the leucocyte count was 17,000 per cubic millimetre.

On February 4, 1924, the radiologist reported no evidence of subphrenic abscess.

On February 12, 1924, his condition was much worse, the leucocyte count was 32,000 per cubic millimetre, and the radiologist now reported that the condition was possibly a subphrenic abscess.

Pus was found under the diaphragm with an exploring needle in the mid-axillary line. As it was located forward in the mid-axilla, the ninth, not the tenth or eleventh, rib was resected. The patient was discharged seven weeks later quite well.

This patient probably had a right anterior subphrenic abscess, but in the right lateral or posterior portion of the space, and localized there by adhesions.

CASE V.—J.O., a male patient, aged thirty-four years, was admitted to the Melbourne Hospital on September 18, 1926. He complained that nine days previously, while driving a cart, he had had a sudden pain in the upper part of the abdomen ("it felt as if something burst"). The pain radiated all over the abdomen, but after a couple of days' rest in bed the pain became localized to the upper part of the abdomen on the left side and around the heart and left shoulder. The rest of the abdomen was not involved. He looked ill on admission. His temperature was 37.9° C. (100.2° F.) and his pulse rate 92. The base of the left lung was dull to percussion. Diminished vesicular murmur, vocal resonance and vocal fremitus were present to the seventh rib posteriorly. The leucocyte count was 15,000 per cubic millimetre.

On September 24, 1926, the temperature rose to 38.3° C. (101° F.) and was swinging. X ray examination suggested the presence of a subphrenic abscess. The left pleura and left posterior subphrenic area were explored by aspiration on the table. Only straw coloured fluid from the pleura was obtained.

On September 30, 1926, exploration was again carried out. Green foul pus was found in the eighth interspace just behind the posterior axillary line at a depth of 6.25 centimetres (two and a half inches). At operation the tenth rib was resected in the posterior axillary line, the diaphragm was sutured to the thoracic wall and the left subphrenic abscess was drained. Foul material was drained until October 18, 1926, when he developed a gastric fistula. He was fed by an ileostomy and eventually recovered after a left sided empyema had been opened. After a holiday at a convalescent hospital he was discharged well, but unfortunately some time later was readmitted to the Melbourne Hospital moribund, with intestinal obstruction. *Post mortem* examination showed that the pleura

and left subphrenic and ileostomy areas were quite healed and death was due to a small bowel intestinal obstruction from a band in the neighbourhood of the appendix. This would have been readily operable had he returned earlier. The pathologist considered the condition unconnected with the previous operative areas, if not with the gastric ulcer which leaked and which was evident as a healed scar on the stomach at *post mortem* examination.

Whether the abscess in this case was a left posterior one or occurred around the spleen I cannot say.

CASE VI.—J.A., a male patient, aged forty years, was admitted to Melbourne Hospital on September 8, 1928. He had been operated on elsewhere for appendicitis, but a perforated duodenal ulcer was found and sutured, and the pelvis was drained. Seventeen days later he was sent to the Melbourne Hospital very ill. His temperature was 38.9° C. (102° F.), his pulse rate was 112, and its volume was poor. Dulness, diminished breath sounds, vocal resonance and vocal fremitus to the angle of the scapula on the right side were present. He had practically no cough or sputum and very little tenderness in the right loin. Exploration was carried out on the table immediately without X ray examination, as he came to hospital on a Sunday. Pus was found in the post-axillary line in the tenth intercostal space. The tenth rib was resected under local anaesthesia and the usual one-stage operation was performed. This abscess was easily the largest subphrenic abscess I have evacuated, and though it was certainly a right posterior abscess, there was so much fluid that it must have extended into the right anterior space as well. The patient was discharged in five weeks perfectly well.

CASE VII.—L.C., a female patient, aged forty years, was operated on in private practice by a gynaecologist, who diagnosed either salpingitis or appendicitis. On November 12, 1929, a gangrenous appendix with pelvic peritonitis was found at operation. Appendicectomy was performed, with drainage. Eight days later the temperature rose to 38.3° C. (101° F.) and the pulse rate to 100; and on the twelfth day after operation the temperature was 39.4° C. (103° F.) and the pulse rate 114. Dulness with diminished vesicular murmur, vocal resonance and vocal fremitus extended almost to the angle of the scapula at the right base, and there was some tenderness in the right loin below the right costal margin. Exploration in the scapular line in the tenth intercostal space revealed *Bacillus coli communis* pus. The eleventh rib was resected, and the usual one-stage evacuation was carried out. Convalescence was uneventful, and the patient was discharged from hospital three weeks later.

In this case the lesion was a right posterior intraperitoneal abscess.

CASE VIII. M.B., a male patient, aged twenty-six years, was seen on October 29, 1929. He was said to have been ill with a sore throat and right sided pleurisy for three weeks. He became much worse, and the day I saw him in consultation with a physician and his local medical man he had had two rigors, his pulse rate was 140 and his temperature 38.3° C. (101° F.). The side of his suspected pleurisy had been needled twice and nothing had been found. On examination the heart was normal in size and position. The left side of the chest was clear. On the right side dulness, with diminished vesicular murmur, vocal resonance and vocal fremitus, extended to the angle of the scapula in the scapular line, but these signs were more marked still in the axilla; the liver was displaced downwards. The liver could be seen and palpated in the epigastrium and the right hypochondrium. The Casoni test gave no reaction.

The diagnosis was intrahepatic abscess and not subphrenic, because there had been no aetiological factor for a subphrenic abscess and because the liver was so enlarged.

On October 30, 1929, under ethylene and oxygen anaesthesia, pus was found far forward beneath the diaphragm between the seventh and eighth ribs; the excursions of the diaphragm were transmitted to the needle. In the mid-axilla

12.5 centimetres (five inches) of the eighth rib were resected, and a one-stage evacuation of a large abscess was performed. I considered the abscess intrahepatic. It was full of bile-stained pus and subsequently drained bile, and was associated with gross hepatic enlargement. An empyema and secondary abscess were opened, but the patient died.

This case is included because, although I considered the abscess intrahepatic and not subphrenic, another surgeon who saw the patient later in consultation considered that it was a subphrenic abscess, possibly secondary to an appendicitis in the first three weeks. I do not consider this so, but thought that in the circumstances it was fairer to include it.

Case IX.—W.M., a male patient, aged thirty-three years, was admitted to the Melbourne Hospital on August 28, 1931. Appendicectomy was performed three weeks before in the country for a seven-day gangrenous appendix with pelvic peritonitis. The temperature, which was 38.3° C. (101° F.) at the time of operation, did not subside, and for fourteen days prior to the patient's admission was around 39.4° C. (103° F.) each night, and the pulse rate was up to 124. He was sent from the country with a diagnosis of a subphrenic abscess, and a small incision had already been made in the right side of the upper part of the abdomen to locate it. On examination he presented a tender, fluctuant mass *per rectum*. This was opened *per rectum* under general anaesthesia and a large pelvic collection was evacuated. His temperature soon subsided, but later he complained of upper abdominal pain and distension developed. His temperature was 38.3° C. (101° F.) and his pulse rate 120. On one or two occasions his temperature rose to 39.4° C. (103° F.). On rectal examination no abnormality was detected. The leucocyte count was 14,500 per cubic millimetre. On October 2, 1931, there was tenderness over the eleventh and twelfth ribs in the post-axillary line, and diminished vesicular murmur, vocal resonance and vocal fremitus were present at the right base. X ray examination on November 9, 1931, gave no indication of subphrenic abscess. X ray examination on October 7, 1931, showed poor excursion and diminished translucency in the lower half of the right side of the chest, but the diaphragm position was not markedly abnormal in the film. The Casoni test gave no reaction.

On October 21, 1931, the twelfth rib was resected after aspiration of pus from the eleventh space. A subphrenic abscess was opened and drained.

On November 4, 1931, the temperature was not down, though the abscess was discharging freely, and the radiologist reported a large area of dullness in the right side of the chest obscuring the diaphragm and going up into the axilla. Fluid aspirated from the right pleura on two occasions in November was straw coloured and sterile.

On November 15, 1931, a right upper paramedian incision was made and pus in large quantities was found between the liver and diaphragm anteriorly. The abscess was drained and the patient's condition improved, but it was not until after December 18, 1931, when the resulting empyema was opened, that he improved so rapidly that he was discharged three and a half weeks later.

In this case the right posterior and right anterior subphrenic spaces both contained pus which passed either round the right lateral margin of the liver or by way of the hepato-renal recess. When the upper abdomen was opened on November 15, 1931, I expected to find the pus in the hepatic renal recess, though possibly the X ray report on November 4, 1931, might have pointed more to the right anterior space being involved.

Case X.—M.J., a female patient, aged twenty-five years, was admitted to the Melbourne Hospital on December 19, 1930. Three days before there had been onset of abdominal pain with diarrhoea and vomiting, and pain localizing in the right iliac fossa. The temperature was 37.9° C. (100.2° F.) and the pulse

rate 118. Clinically the condition was a very definite appendicitis with pelvic peritonitis. Appendectomy was performed by the right paramedian route and drainage was adopted. There was free fluid and the appendix was gangrenous, perforated and extracaecal. The temperature did not subside and twice the patient had a rigor. As dulness with diminished breath sounds, vocal resonance and vocal fremitus was present at the right base, exploration was carried out on January 21, 1931, under ethylene and oxygen anaesthesia. Pus was found beneath the diaphragm and a portion of the eleventh rib was excised; a one-stage evacuation was performed and the abscess was drained. The temperature dropped and was normal on January 30, 1931. Recovery looked certain when, following two rigors, the temperature did not again fall below 38.3° C. (101° F.) at night and in spite of further exploration death occurred.

*Post mortem* examination revealed two small abscesses in the upper portion of the right lobe of the liver and the subphrenic abscess empty and communicating by the sinus with the exterior. There were abscesses in the lungs.

This list includes only proved cases of subphrenic abscess operated by me and completely under my care. Several very ill patients have been seen in consultation in whom the possibility of a subphrenic abscess has been raised but not proved. One patient attended to for a short period only for another surgeon who was on holiday, is not included. It is possible that a patient who died from what was classified by the pathologist at the Melbourne Hospital as a retroperitoneal abscess around the pancreas after a Pólya gastrectomy, should be included. These abscesses are subphrenic and tend to spread in the retroperitoneal cellular tissue; they are also seen after pancreatitis. The case referred to above, which I saw when acting as a *locum tenens* for another surgeon, was one such. These abscesses are difficult to deal with and have a high mortality.

#### ANALYSIS OF CASES.

The total number of cases was ten. Eight patients recovered and two died.

Case VIII was never regarded by me as a subphrenic abscess, but as an intrahepatic abscess. If that be excluded, the figures then read: total, nine; recoveries, eight; death, one.

If the retroperitoneal abscess around the pancreas is included (and an effort was made to drain the abscess by a posterior approach), the figures would again read: total, ten; recoveries, eight; deaths, two.

In regard to the location of the eleven abscesses, in Case III two abscesses were present. Right posterior abscess was present in five cases. Right anterior abscess was present in two cases. Perisplenic abscess was present in two cases. A combined right posterior and right anterior abscess was present in one case. An intrahepatic abscess was present in one case.

#### DIAGNOSIS.

When a patient following an operation for an acute abdominal inflammatory or perforating lesion, or following an upper abdominal operation, instead of progressing favourably or after progressing favourably for a few days manifests a raised temperature and pulse rate and

a dirty tongue, and is inclined to sweat and in some cases has rigors, secondary abscess formation in the abdomen should be at once considered. A rectal or vaginal examination will at once exclude an abscess in the pelvis. Attention should then be directed to the bases of the pleural cavities, especially the right side. Here "lots of pulmonary signs and very few pulmonary symptoms" direct attention to the possibility of a subphrenic abscess. By that is meant that even with dullness up the inferior angle of the scapula and corresponding diminished vesicular murmur, vocal fremitus and vocal resonance, there is very little in the nature of true pleural pain, little cough and little, if any, sputum, the respiratory rate is little increased, while the breath is not offensive—a point of some importance, as these cases are as a rule, partly if not solely, *Bacillus coli communis* infections. It is not meant to infer that these patients have no pain, cough or sputum in the early stages. The pain that is present will be discussed later; but the relative degree of pleural pain, cough and sputum are not in keeping with the physical signs at the base of the lung so far as post-operative bronchopneumonia infarcts, pleurisy and empyema are concerned. When the further complication of the condition, namely an empyema or pyo-pneumothorax, is later encountered, the difference is obvious. Then the cough is more marked, sputum is more abundant and offensive from the nature of the infection, and the breath is offensive. The leucocyte count is raised anywhere up to 20,000 cells per cubic millimetre or more, and should always be recorded.

#### *Pain.*

Pain is frequently present in the loin or over the upper portion of the *rectus abdominalis* muscle just beneath the ribs, and pleural pain and irritation may be enough to cause some slight cough and increase in the respiratory rate, but this has never in my experience been comparable to the pain or dyspnoea present in an acute pleurisy or pneumonia. The pain in the loin and at the costal margin is frequently accompanied by tenderness on pressure. The liver edge may be depressed, but never markedly and only at all with a large abscess. With suspicion raised as to the possibility of a subphrenic collection being present, confirmation can be attained only by X ray investigation, exploratory puncture or laparotomy.

#### *Exploratory Puncture.*

Very frequently a pleural effusion is suspected and a needle is inserted into the pleural cavity, some straw coloured fluid is withdrawn and preparations are made for aspiration of the effusion, only to find at aspiration that almost all the fluid was withdrawn at the exploratory puncture. There is a little fluid in the pleura, as one would expect from an extension of the inflammation to the pleural membrane, but it is as a rule very limited in amount. This happened in several of the cases of the series, and suggests either the possibility of loculation in the pleura, which other punctures will eliminate, or that the causative factor is beneath the diaphragm; and it is a time-honoured

exhortation never to make an exploration through the diaphragm unless the patient is in the operating theatre.

X ray investigation is sometimes hampered by the serious condition of the patient; depending on the size of the collection, the diaphragm is absolutely or relatively immobile and raised markedly as compared with the other side or with its usual position. If it is possible to make the patient sit upright, a gas and fluid level may be seen; this may also happen with the patient in the lateral position. From radiography one hopes to obtain confirmation of the diagnosis and, secondly, some indication of the position of the abscess and where it is closest to the surface. The last mentioned is possible, I think, only when a fluid level is demonstrable with the patient either in the lateral or upright position. The absence of gross pathological change above the diaphragm is also confirmed.

#### *Increase of Liver Dulness Downward.*

While there may be tenderness at the costal margin towards the loin, and in some cases a right or left anterior abscess may point below the costal margin, unless it is a large subphrenic abscess there is as a rule no gross enlargement of the liver downwards. This is in contrast to many cases of intrahepatic suppuration from which subphrenic abscess has to be distinguished. In these cases, chiefly instanced in this country in suppurating hydatid cysts, the inflammatory reaction throughout the liver, even if the hydatid cyst is on the upper surface, results in so great an enlargement of the liver that clinically as a rule there is evidence of enlargement downwards as well as upwards. While suppuration within a hydatid results in this marked enlargement of the liver both upwards and downwards, cases are seen from time to time in which infection apparently by way of the portal tract results in single or multiple abscess formation in the liver, without the general dissemination of a pylophlebitis and without jaundice. Case X is such a case, and although there the possibility of direct implantation of the infection was raised, I have seen similar cases follow resection of the colon and other abdominal operations. At *post mortem* examination there has been one, or more than one, small abscess in the liver and not a marked increase in the size of the liver. I know of one other case exactly similar to Case X, that is, hepatic abscesses complicating a subphrenic abscess which supervened on an appendicitis. Both these cases were proved *post mortem*, so that when a subphrenic abscess has been opened and is draining satisfactorily, but the patient is not progressing favourably, even if the liver is not grossly enlarged, the possibility of intrahepatic suppuration must be considered. The absence of gross hepatic enlargement prior to operation does not necessarily imply that the suppuration is not in the liver, though it renders the possibility of an infected hydatid unlikely.

#### *Jaundice.*

Jaundice is much more frequently associated with intrahepatic than with subphrenic suppuration. In the series of cases cited jaundice was

evident clinically only once, in Case VIII. In this instance it was considered to be an intrahepatic abscess, and in no other cases in the series was jaundice a clinical entity.

#### *Empyema.*

The classical signs of empyema or pleural effusion, as indicated by the line of the dullness, cough, sputum, offensive breath, displaced apex beat *et cetera*, will be confirmed by X ray examination and an exploring needle permits ready differentiation of empyema from subphrenic collection.

#### *Gas in the Abscess or the Pleural Cavity.*

I have not been able clinically to demonstrate gas in the abscess beneath the diaphragm, and apart from radiographical demonstration it seems unlikely that demonstration would be possible often enough to be of value. In Case I, however, in which the patient subsequently developed a pyo-pneumothorax, all the classical signs of that condition were present, dullness, tympany, *bruit d'airain*. In some cases it is possible to demonstrate clinically lung, fluid, air, liver, and liver edge below the costal margin. The primary lesion, if there is one, and the history of the case will often help in the correct diagnosis, and if there has been a previous acute abdominal catastrophe that, of course, is of considerable significance.

#### *The Level of the Line of Dullness.*

In the large subphrenic abscesses the whole of the base of the pleural cavity is dull, in some cases almost to the level of the angle of the scapula. In some of the smaller abscesses, the dullness is more marked over a limited area, leaving portion of the base relatively clear. Examination of the base of the right lung sometimes reveals normal resonance between the spine and the line of the vertebral border of the scapula, but with a line of dullness 7.5 centimetres (three inches) above the normal between the vertebral border of the scapula and the mid-axillary line. In these cases the diagnosis has to be made from a loculated empyema, and the localized dullness is also of importance in determination of the site of the abscess. These clinical signs can be confirmed radiographically.

#### RADIOGRAPHIC CONFIRMATION OF THE DIAGNOSIS.

Radiographic confirmation of the diagnosis might be considered to be indirect and direct; the indirect signs are a raised diaphragm which is immobile or the movement of which is restricted, but the costo-phrenic and pericardiophrenic angles are not opaque, the base of the pleura at the examination being clear or at the most showing the evidence of the small amount of fluid that is often present in these cases. The direct signs are the definite evidence of an air bubble with an air and fluid level. These patients are sometimes desperately ill, and the direct signs are not likely to be elicited unless the patient can be examined in the erect and lateral position, and then only if the abscess contains

gas. The demonstration of a gas bubble is diagnostic, and also furnishes some idea of where the abscess approaches the lateral thoracic wall; it was, however, not demonstrated in any case in the series.

The raised diaphragm alone indicates the possibility of a subphrenic abscess only and furnishes little, if any, indication of where the abscess approaches the surface. The question of the significance of a raised diaphragm in the diagnosis of subphrenic abscess is one that merits further investigation, and how fallacious it can be will be seen later. The patient cited below was seen with a consulting physician, and although the primary lesion did not indicate a subphrenic abscess suggestive signs were present, namely, dulness, diminished vesicular murmur, vocal resonance and vocal fremitus at the base of the right lung, very little cough or sputum, a high temperature and pulse rate, and a displaced apex beat. X ray examination revealed a raised right diaphragm and a clear right base. This patient was explored and had no subphrenic abscess, and subsequently made a good recovery, in spite of the treatment. The patient clearly must have had an associated paralysis of the phrenic nerve on that side or some eventration or congenital elevation of the diaphragm. As to how often such cases occur I have no knowledge, but it has been suggested that they occur occasionally as a complication of very acute pleurisy or pneumonia with extensive pleural involvement or possible involvement of the phrenic. If this condition is at all prevalent, mistakes must occur if too much reliance is placed on a raised diaphragm in arriving at a diagnosis of subphrenic abscess.

E.J., aged forty-five years, female, was admitted to the Melbourne Hospital on June 18, 1932. Following termination of a pregnancy over one month previously, the patient had pneumonia, and while delirious jumped from a window and fractured her pelvis and arm. From the pneumonia she had never recovered, and still had some cough, a little sputum, and a persistent evening temperature up to  $38^{\circ}$  to  $38.3^{\circ}$  C. ( $100.5^{\circ}$  to  $101^{\circ}$  F.) and always above  $37.4^{\circ}$  C. ( $99.4^{\circ}$  F.). The pulse rate was 108. Examination of the heart showed that the apex beat was 13.1 centimetres (five and a quarter inches) from the mid-line and that no dulness was present to the right of the sternum. In the left lung nothing very definite was found; at the base of the right lung dulness with diminished vesicular murmur, vocal resonance and vocal fremitus to the angle of the scapula were found.

Abdominal, vaginal and rectal examination revealed nothing abnormal. The white cell count was 12,000 per cubic millimetre.

Clinically a diagnosis of empyema was made till the films and reports of two X ray examinations by two different radiographers showed that the lungs were apparently clear. The heart shadow was enlarged and displaced to the left. The left side of the diaphragm was normal, the right side was above the normal level and almost immobile. The condition was then regarded by all as a subphrenic abscess. However, exploration revealed nothing and in two and a half weeks the rise in temperature and pulse rate had subsided completely and the patient recovered.

#### LOCALIZATION OF THE ABSCESS.

Exploratory puncture or laparotomy will localize the abscess. Nearly all the abscesses in this series were localized by exploratory puncture in the operating theatre, and some patients were certainly too ill to submit

to exploratory laparotomy. It is, of course, only abscesses posteriorly placed that are suitable for puncture, and here the exploration should be in the area between the vertebral border of the scapula and the mid-axillary line over an area from the seventh to the eleventh interspace. Can damage be done by spreading the infection by exploratory puncture? The possibilities seemed to be limited to infection of the pleura till Case X occurred, and as infection of the pleura on the right side is the natural spread of the condition, it is almost impossible to say whether puncture has caused the spread or not. In Case X, *post mortem* examination revealed two abscesses in the upper portion of the right lobe of the liver, not very far from the periphery. Here the possibility of these being due to implantation infection as a result of the needle traversing thick pus and passing further, implanting pus in the liver, cannot be dismissed by saying that those abscesses were certainly due to portal pyemia from the gangrenous appendiceal region. No hard and fast rule can be laid down and each case must be treated on its merits, but it seems that in a very sick patient a direct attack on an already localized abscess affords more hope of a successful outcome than a preliminary exploratory laparotomy, and will not be fraught with so much risk. The risk of infection of the pleura by puncture is lessened by the adhesions formed and, if the abscess has been localized posteriorly by puncture, posterior drainage under local anaesthesia is the treatment that affords the best prognosis. If the abscess is not localized, then laparotomy must be carried out. Doherty and Rowlands,<sup>(3)</sup> however, make a strong plea for diagnostic laparotomy and so also does Russell.<sup>(4)</sup>

Exploratory puncture may be unreliable: (a) because there is only a thin layer of inspissated pus between the diaphragm and liver, and the needle traverses it without aspiration; (b) because the abscess, though present, is not in that subdivision of the subphrenic space explored (Cases II and IX); (c) because on the right side (Figures I and II) in the presence of suppuration under the posterior portion of the right half of the diaphragm, if the abscess lies between the liver and the diaphragm in relation with the dorsal surface of the liver below the coronary reflection, the plane of the abscess is at right angles to the line of the exploring needle and will probably readily be located; but if the collection is largely in the hepato-renal recess, the long axis of the abscess tends to approximate the plane of the exploring needle, and this means that the narrow posterior dimension of the abscess cavity must be entered by the needle. It is clear from Figures I and II how easy it will be to fail to locate the pus.

#### TREATMENT.

In planning treatment we must remember that the majority of these abscesses are right sided and in my experience tend to be more frequently situated posteriorly than anteriorly. Sometimes they are not accurately confined to the right posterior intraperitoneal space, but tend to spread somewhat between the posterior portion of the right lateral surface of the liver and the thoracic wall. If we remember these facts,

and if it is true that a direct attack on the localized abscess is preferable to laparotomy, it becomes a question whether the approach is to be (a) transthoracic or (b) infracostal.

If the abscess has reached the stage of pointing, or if localized fullness is present below the costal margin dorsally, no question can arise; drainage practically is provided. These cases must be rare and denote a chronicity of development and of clinical course that is not very usual. Anterior collections point below the costal margin sooner and oftener than posterior collections.

If the abscess has been localized posteriorly, subsequent aspiration in the same line, but through lower interspaces with fresh syringes and needles, may indicate its lowest level and give some idea whether it is likely to be reached from below the costal margin. While realizing the advantages to be gained by not traversing even an obliterated pleural cavity posteriorly because of the risk of empyema following, I must confess that my happiest results have been obtained by disregarding these advantages and by using transthoracic drainage. I do not wish to infer that infracostal incision is not the approach of choice; it must be, but it seems to be applicable as a routine measure only to those abscesses localized as low as the tenth or eleventh space. Without a large incision through the thick muscle of the lateral abdominal wall it is anything but easy to explore the hepato-renal recess and the area between the liver and diaphragm; this approach was however used successfully in Case IX. With transthoracic drainage the aim is to be so low down that the costal and diaphragmatic layers of the pleura will be adherent due to the raised diaphragm, and thus the pleural cavity will not be opened.

There are a few points to emphasize in the operation, which is best carried out under local anaesthesia. Regard must be paid to the position of the localized abscess, but the incision should be as low as possible, the tenth or, better still, the eleventh rib being resected. The incision wants to be ample to allow of resection of 10.0 or 12.5 centimetres (four or five inches) of rib; this allows more elasticity of the thoracic wall and facilitates suture to the diaphragm. It is often possible to see that the two layers of pleura are adherent, but sutures should always be passed between the thoracic wall and the diaphragm. As the phrenico-costal sinus is much narrower anteriorly than posteriorly, the suturing should be commenced there. So as to be sure to reach the diaphragm easily, a long piece of catgut on a half circle needle should be used; and to avoid sucking, after each stitch the needle should be retraced and entered half-way between the point of entry and exit of that stitch. In this way the diaphragm is sutured to the thorax over an oblong area which will provide ample room for incision without cutting the encircling suture, and which will permit subsequent exploration and drainage. This suture should unite the intercostal muscles above and below the resected rib and the diaphragm, and not the stripped periosteum and the diaphragm, as the stripped periosteum tears and then pneumothorax and infection occur. With the encircling suture, however,

the stripped periosteum must be sutured to the diaphragm at each of the narrow ends of the oblong. The exploring needle is again inserted, the pus is localized and the incision through the periosteum and diaphragm follows the line of the needle; the abscess is opened, a tube is inserted, and the wound is closed.

With all transthoracic approaches to the upper abdominal cavity the controversy of the one- or two-stage operation arises. The one-stage has been outlined above. The two-stage operation ceases at the first stage with the rib section, the wound is packed and closed, to be opened several days later when protective adhesions have formed. Here practice varies. My own preference is for a one-stage operation in all transthoracic approaches and especially in subphrenic abscesses, where it is always possible to keep very low down, so that if adhesions have not formed it is easy to suture the diaphragm to the thoracic wall. The objections to the two-stage operation are: (i) delay must occur; (ii) adhesions sometimes do not form, a pleural effusion results and this is opened on the second stage; (iii) rigidity and infiltration around the incision restrict considerably the field of approach at the second stage. When the abscess has been evacuated and drained, general nutritional treatment is all that is necessary, a close watch being kept for extension to the pleura.

Right anterior and left anterior abscesses may form swellings, often palpable below the costal margin, with temperature, pulse and leucocyte count raised and with tenderness over the ribs ventrally, the signs as a rule being strictly limited to one side. These abscesses are best opened and drained through an incision to the right or left of the middle line as the case may be.

The left posterior intraperitoneal abscess is best opened anteriorly through an incision traversing the gastro-hepatic or the great omentum above or below the stomach, an approach well illustrated in all articles on pseudo-cysts of the pancreas; these cysts indeed may be taken as the outline of a left post-intraperitoneal abscess. If large, the swelling extends from costal margin to umbilicus and from mid-line or a little beyond to the left costal margin in the region of the spleen.

One abscess in the series was around the spleen and was opened on exactly similar lines to the right posterior intraperitoneal abscesses.

#### REASONS FOR FAILURE OF TREATMENT.

The reasons for failure of treatment are:

1. Loculation of the abscess cavity with inadequate drainage. This has been most evident in right post-intraperitoneal abscesses, and again Figures I and II show the reason. If the hepato-renal recess and the area between the diaphragm and the posterior surface of the liver below the coronary ligature are distended with pus, as they are on different planes, drainage of one plane with collapse of the walls of its cavity may not always provide drainage for the cavity in the other plane.

2. Sometimes the abscess is opened and drained at its summit or at its point of most recent extension and the track whence it has come

is neglected. For example, an abscess may track up along the side of the colon to the hepato-renal recess and then to the posterior surface of the liver, where it is opened, the track being neglected.

3. Right posterior abscesses are often associated with right anterior abscesses and both must be opened (Case IX and Barnard's article).

#### RETROSPECT.

1. Exploration and direct attack on the localized abscess preferably under local anaesthesia must be the method of choice.

2. Direct attack below the pleural reflection seems ideal, although it was not often successfully used in this series. It would appear that the development of empyema might be minimized by first localizing the abscess and then with fresh needle and syringe tracing it downwards through successive intercostal spaces till its route of subpleural drainage is indicated. In the posterior abscesses this might diminish the high percentage of empyemas which occurred in this series—four cases.

3. When this method, that is, exploratory puncture, fails to localize the abscess, laparotomy is essential. Exploratory incision by the trans-thoracic route is wrong, and should not have been carried out in Case II because the extent of the exploration was hopelessly restricted. Laparotomy was too long delayed in both Cases II and IX.

4. Case IX, considered in conjunction with Barnard's figures, suggests that when a right posterior abscess has been opened and is draining, but the patient is not progressing favourably, if empyema can be excluded, the abdomen should be opened. Right posterior abscesses are very often associated with abscesses in the anterior space, and, in Barnard's cases, never occurred alone and uncomplicated by pus in other spaces. In 76 subphrenic abscesses reported by him, ten occurred in the right post-subphrenic space, and in nine of these pus was present in the right anterior space as well.

5. Case X raises the question of the possibility of hepatic infection following exploratory puncture. If this infection was a result of direct implantation and did not occur by way of the portal vein, then the risk is there. How this risk may be avoided it is difficult to see.

6. If the cases cited of elevation of the diaphragm due to eventration, pulmonary adhesion or phrenic paralysis prove to be at all common, X ray diagnosis to be reliable will need to reveal a gas and fluid level which, besides being diagnostic, will localize the abscess.

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## OPERATIONS FOR THE RELIEF OF TRICHIASIS AND CICATRICIAL ENTROPION.

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THE following article is based on the results obtained from a series of nearly eight hundred operations for the relief of trichiasis and entropion, performed by me at the British Ophthalmic Hospital, Jerusalem. The technique described is that in use there, and has become standardized as the result of the experience of many years in a rich field. It is no exaggeration to say that the incidence of trachoma is almost universal amongst the fellaheen and bedouins of Palestine and Transjordan. There are few facilities for obtaining treatment. As a result, ingrowing eyelashes are very common, up to four thousand patients a year applying to the hospital for relief from this condition.

The methods adopted are by no means novel. Nevertheless, textbook descriptions are often lacking in the details so essential in such small plastic operations.

The subject may best be approached under the following heads: (i) pathological anatomy; (ii) general principles; (iii) instruments necessary; (iv) analgesia or anaesthesia; (v) description of the operations: (a) Van Millingen, (b) Spencer-Watson, (c) Snellen; (vi) results.

### PATHOLOGICAL ANATOMY.

Any or all of the following conditions may be present: (a) trichiasis, (b) cicatricial entropion, (c) blepharospasm, (d) rounding of the posterior lip of the free palpebral margin, (e) narrowing of the palpebral fissure.

Trichiasis may occur without entropion, and is the result of the condition of chronic inflammation of the tissues. New lashes appear, growing in all directions, some of which, pointing backwards, irritate the eye. They may be scattered along the lid border, or occur in clumps which are occasionally confined to an area near the canthi. A true distichiasis may be seen. It is important to realize that trichiasis may occur without entropion.

If the scarring of the lids is severe, the tarsus becomes buckled and the lash-bearing area rotated inwards, that is, entropion is now present.

Varying grades of blepharospasm result from the constant irritation of the lashes. This will tend to aggravate any entropion present.

As the lash-bearing area turns in, the posterior lip of the free palpebral margin becomes rounded off by pressure against the globe, and

the interpalpebral and ocular surfaces of the lid merge imperceptibly into each other. The importance of this will be seen when discussing the site of the graft in Van Millingen's operation.

The surrounding skin becomes excoriated by the constant discharge, and contracts, leading to a narrowing of the palpebral fissure at the outer canthus.

#### GENERAL PRINCIPLES.

Operations for correcting the deformity of the lids fall into two main groups, those which seek to gain their effect by pushing the lashes away from the globe, and those which attempt to rotate the whole lash-bearing area outwards. To the first group belong the methods of Van Millingen, Jaesche-Arlt and Spencer-Watson. Of these, the operation of Van Millingen is undoubtedly the best, the lashes being pushed outwards by the insertion of a graft of mucous membrane from the lip into the lid margin. As in the other members of the group, no attempt is made to remedy the entropion. Hence it is inapplicable to cases in which this is present in a severe degree. Spencer-Watson achieved the same result as Van Millingen with a pedicle graft of skin from the lid. The small hairs of the graft, however, prove as irritating as the lashes, and it is used today only in a modified form, for cases of trichiasis confined to areas near the canthi.

To the second group belong the methods of Snellen, Hotz-Anagostaki, Panas and Burow. Snellen's operation is developed from that of Hotz-Anagostaki. Instead of the tarsus being thinned and folded so as to turn the lashes out, a wedge of tarsus is excised to produce the same effect. Panas made a free flap of the lash-bearing area and sutured it perpendicularly to the anterior surface of the tarsus. By making a similar flap from the conjunctival surface, Burow allowed the lid margin to rotate outwards. In a modification of his operation, a graft of mucous membrane is inserted into the incision to prevent recurrence.

Experience in Jerusalem has shown that most cases can be dealt with successfully by the Van Millingen operation. Severe grades of entropion demand Snellen's operation. Owing to the contraction at the outer canthus, difficulty is sometimes experienced in getting sufficient outward rotation at this point. A canthoplasty will now allow the operation to have its full effect. When the trichiasis is confined to the ends of the lids, a Spencer-Watson operation will suffice.

#### INSTRUMENTS NECESSARY.

The following instruments are necessary: a small scalpel, a pair of curved and a pair of straight scissors, a pair of conjunctival fixation forceps, a pair of small toothless forceps, a lid spatula, a squint hook, a needle-holder, number two advancement needles, number one silk sutures.

The scalpel should not be too small and should have a well curved blade. A keen edge on the cutting instruments is essential. For rapid work a pair of dissecting forceps is an excellent needle-holder.

## ANALGESIA OR ANÆSTHESIA.

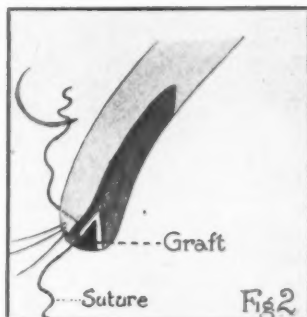
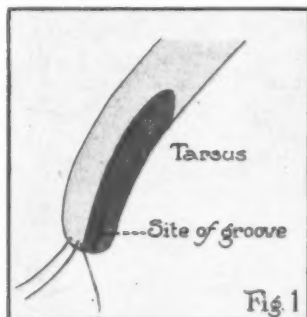
A general anæsthetic is necessary only with young children. Local analgesia is obtained by injecting the lid with 1.5 cubic centimetres of a 4% solution of "Novocain", and instilling a drop of a 5% solution of cocaine hydrochloride into the conjunctival sac ten minutes before operation. Adrenaline is not used when doing a lip graft for fear of impairing the vitality of the mucous membrane. It is a help in the other operations.

The mucous membrane of the lower lip is rendered analgesic by a gauze pad soaked in 5% cocaine hydrochloride placed between the teeth and the lip, the patient then keeping the mouth firmly closed.

## DESCRIPTION OF OPERATIONS.

*The Van Millingen Operation.*

The use of the lid spatula is unnecessary in the Van Millingen operation. By pulling back the skin of the lid gently with the fingers



of the left hand, the tarsus is made to stand on end with the interpalpebral border upwards. According to the usual descriptions of the operation, the next step is to split the lid margin along the "white line". This has usually disappeared, as has the posterior border of the interpalpebral margin. In the absence of these landmarks, the incision must lie just behind the lashes and as close to them as possible. It must stretch right across the lid from the outer canthus to a point in front of the canaliculus (Figures 1 and 3). If necessary, it may run out on to the skin of the canthus. A shallow incision is first made as a guide. Keeping the blade parallel with the ocular surface of the lid, this is increased to a depth of three millimetres. Care must be taken not to cut across any of the follicles of the lashes. Should this occur, the follicle must be picked out with the point of the knife or, better, an incision made behind it, and the flap, so formed, fastened with one of the fixation sutures to the anterior wall of the groove. Unless this is done, lashes will appear later at the posterior border of the graft, the

condition being aggravated instead of being relieved. (That this may happen has been advanced as a weak point in the method; it is really only evidence of carelessness on the part of the surgeon.)

In fashioning the groove it is of the utmost importance to work with the belly of the knife. Beginners often use the point, and have the greatest difficulty in fashioning what is, ultimately, a very ragged groove.

When the incision is deep enough, three fixation sutures are passed from within, through the anterior wall, under the roots of the lashes and emerging through the skin of the lid just above (Figure 2). They are left as long loops for fastening to the brow or cheek later.

The next step is the fashioning of the graft. The pad is removed from the mouth, the lip is everted and pressed firmly against the chin with the thumb and forefinger of the surgeon's left hand. With two strokes of the knife, cutting down to the submucous fat, a piece of



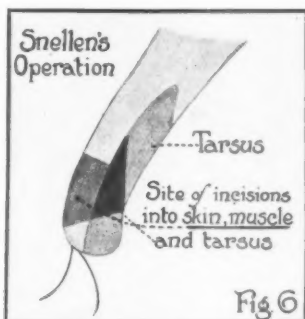
mucous membrane the requisite length, two to three millimetres wide, and with pointed ends, is outlined. The assistant takes control of the lip, and the graft is removed by lifting one end with the fixation forceps and cutting it away from the submucous fat with the straight scissors. To control bleeding a pad of gauze is placed between the lip and teeth and the mouth firmly closed. The wound may be sutured at the end of the operation, healing being just as rapid and comfortable if this is not done. The graft, meanwhile, is stretched with the epithelial surface downwards on the thenar eminence of the surgeon's left hand and all the fat removed with the curved scissors. Here again the work must be done with the curve of the blades. Working with the points, it is easy to cut the graft in two and ruin it. To prevent it from sticking to the scissors they are kept moistened with saline solution.

When the graft is ready the tarsus is again stood on end and the groove opened up and cleared of blood clot. The graft is picked up with the toothless forceps and placed in the groove, where it is smoothed into position with the squint-hook. It must fit snugly into the corners,

and is better a little short, as it will stretch and fit more easily. It is unnecessary to control bleeding before inserting the graft, all hæmorrhage ceasing as soon as it is in position. It is finally pressed firmly into position with a damp sponge and the lid is everted and held by fastening the sutures with strapping to the brow, in the case of the upper lid, and the cheek in the case of the lower. The eye is covered with a piece of lint smeared with a thin layer of vaseline. Cotton wool is placed over this, a cartella shield and a bandage.

The eye is inspected daily, but not irrigated, a drop of 5% protargol being instilled instead. The sutures are removed on the second day after operation and the dressings are discarded on the third.

One, two, three or all four lids may be done at the same time. Rarely does the graft fail to take. Unsatisfactory results follow one that is too short. The patient will complain of discomfort if it is too thick. Relief follows trimming with a pair of scissors.



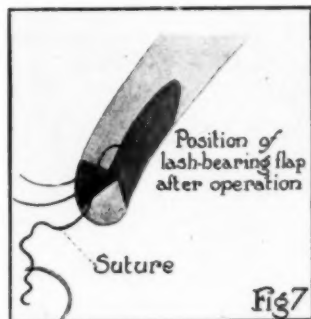
#### *The Spencer-Watson Operation.*

The line of incision is shown in Figure 4. Commencing on the interpalpebral margin just behind the affected area, it runs out on to the canthus, curves back just above the lashes to a point opposite its origin, and again doubles back to the canthus. The incision forms two triangles, the base of the second one being two to three millimetres wide. The two flaps are undermined, exchanged and each fastened in the new position with a single suture at the apex (Figure 5). When undermining the lash-bearing area, no follicle must be left behind. The eye is covered with a pad and bandage. It is inspected daily. The sutures are removed after three days and the eye left open.

#### *The Snellen Operation.*

The spatula is inserted under the lid and held by the assistant. By depressing the free end and elevating the other, the tissues are stretched and bleeding controlled. The first incision is made just above the lashes. It extends from canthus to canthus and reaches down to

the tarsus. A similar incision, meeting the first one at the ends and two millimetres wide in the centre, is made above it. The piece of skin and muscle outlined is removed with the scissors (Figure 6). The skin and the fibres of the orbicularis muscle are stripped back from the tarsus by blunt dissection, and held out of the way by slipping them over the end of the spatula pushed well up into the fornix. The small strip of muscle left just above the roots of the lashes must be dissected out. An incision through the tarsus and extending right across it is now made immediately above the roots of the lashes. Button-holing the conjunctiva is not a grave mistake, but is not difficult to avoid, the trachomatous tarsus being very thick. The second incision into the tarsus is a curved shelving one. It is three millimetres distant from the first at the centre of the outer surface, and meet it at the ends and the conjunctiva (Figures 6 and 8). If they are accurately



placed, the wedge outlined will lift out. If not, it may be removed with scissors.

Three sutures are inserted, one in the centre of the lid and one at each end (Figure 8). They enter the interpalpebral border behind the lashes, and emerge between them and the first incision into the tarsus (Figures 7 and 8). Entering the anterior surface of the upper tarsal flap, they take a direction parallel to the lid margin. After a distance of two to three millimetres they emerge to return through the lower flap. A good hold of the tarsus is essential. If there is any difficulty in getting this with the outer sutures, they may be "staggered" in towards the centre. Finally the flaps are gently pressed together and held by fastening the untied sutures to the brow with strapping. The skin is not sutured. The eye is covered with a pad and bandage and inspected daily. The sutures are removed on the third day, and the eye left open on the fourth.

#### RESULTS.

Using these methods, it was not difficult to get a good immediate result. The majority of the patients left Jerusalem a few days after

operation and did not bother about any further treatment. With the march of the cicatricial process, recurrence was common. When it was possible to give adequate after-treatment of the trachoma, recurrences were rare.

Should entropion occur in a lid into which a lip graft has been inserted, there is no difficulty in now doing a "Snellen". If entropion should recur after a "Snellen", there is often great difficulty in repeating the operation, a large part of the tarsus having been removed. A lip graft is of value in these cases.

#### SUMMARY.

1. The pathology of trichiasis and cicatricial entropion occurring during the course of trachoma has been described.
2. The general principles underlying operative treatment of the above conditions have been discussed.
3. Based on experience gained at the British Ophthalmic Hospital, Jerusalem, the detailed technique of the operations of Van Millingen, Spencer-Watson and Snellen has been described.
4. The immediate results showed that the operations were effective, recurrences being due to neglected treatment of the trachoma.

#### ACKNOWLEDGEMENTS.

My thanks are due to Dr. J. C. Strathearn, Warden of the British Ophthalmic Hospital, Jerusalem, and to Dr. Norman Manson, Sub-Warden, for the very valuable help given to me whilst working with them, and without which the compilation of this article would not have been possible.

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## RADIOGRAPHY IN THE DIAGNOSIS OF INTRACRANIAL TUMOURS.

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RADIOGRAPHIC examination of the skull and intracranial contents has become an important method in the diagnosis and localization of intracranial tumours. The general radiographic signs of increased intracranial pressure are now well recognized and may be tabulated as follows:

1. Convolutional thinning or "thumbing" of the inner table of the skull.
2. Separation of sutures (particularly in children before bony union of sutures has taken place).
3. Distension of the pituitary fossa without erosion of the *dorsum sellae*.

Convolutional markings are normally present in children and young adults, but after the twenty-fifth year they may be interpreted as the result of a definite persistent increase of intracranial tension. In children wide separation of sutures tends to minimize the effect of persistent increased intracranial pressure in producing convolutional thinning of the inner table of the skull, unless the skull is abnormally dense and hard, or the sutures have interlocked early. In Figure I convolutional thinning is evident over the whole of the inner table, particularly in the frontal region, where the characteristic "beaten silver" appearance is produced. This patient was a boy of twelve with bilateral papilloedema. There was no separation of sutures, and the lambdoidal suture can be seen to be well interlocked. The interpretation of this amount of convolutional thinning with no separation of sutures in a child of this age would have been difficult in the absence of papilloedema and the definite localizing signs, to be discussed later, which are also present in the radiogram.

Figure II is a radiogram of the skull of a boy aged twelve who had bilateral papilloedema due to disturbance of the cerebro-spinal fluid circulation caused by basal arachnoiditis. In this patient, owing to separation of sutures seen most clearly at the coronal suture, there was no abnormal convolutional thinning to be seen.

Distension or "ballooning" of the *sella turcica* often occurs after an increase of intracranial tension has persisted for some time. This distension, a typical example of which is seen in Figure III, may at first sight appear to resemble the changes which occur in this region in cases of adenoma of the pituitary gland. Closer inspection of a *sella turcica* which has been distended solely by general increased intracranial pressure, invariably reveals no irregular erosion of the *dorsum sellae* and

little or no disturbance of the contours of the clinoid processes. In these secondarily distended sellæ the term "ballooned" is an apt description, since the regular uneroded surface of the *dorsum sellæ*, which is usually thinned out, suggests the outline of portion of the envelope of a balloon. Adenomas of the pituitary gland produce primary enlargement of the *sella turcica*, and the resulting picture, which will be dealt with later, presents a marked contrast to the ballooned appear-

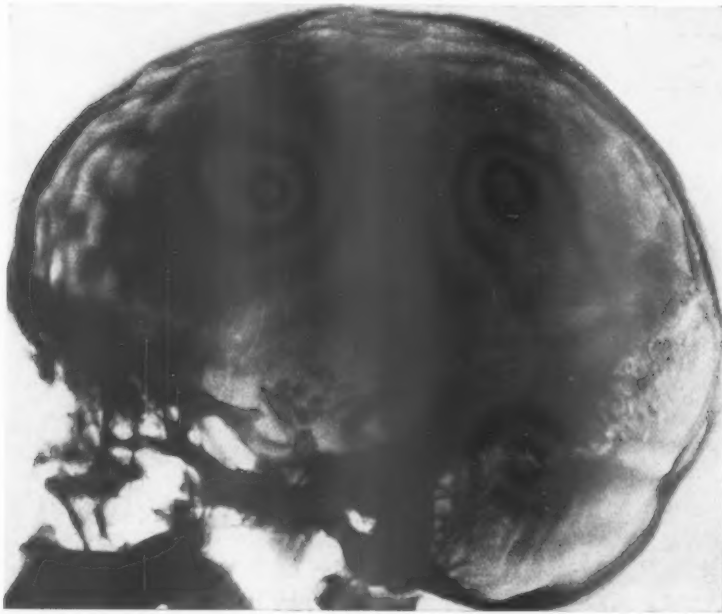


FIGURE I. Right lateral radiogram of the skull of a boy, aged twelve, showing: A, great increase of convolutional thinning; B, diffuse suprasellar calcification; C, advanced erosion of the posterior clinoid processes. Diagnosis: Calcified cranio-pharyngeal pouch cyst.

ance of secondary distension. "Ballooning" of the *sella turcica* occurs most frequently in patients suffering from tumours situated in the posterior fossa of the skull. Tumours in this situation interfere early with cerebro-spinal fluid circulation, and the patient soon exhibits marked general symptoms of increased intracranial pressure. A radiogram of such a case is seen in Figure XV, where a typical "ballooned" sella has been produced.

#### LOCALIZING RADIOGRAPHIC SIGNS.

Under this heading may be considered those radiographic appearances which definitely localize an intracranial neoplasm or which provide

evidence that it is situated either above or below the *tentorium cerebelli* or in one cerebral hemisphere or the other. The full significance of localizing signs may be appreciated only in stereoscopic radiograms, since both the intensity and depth, as well as the character of abnormalities, are of value in arriving at a diagnosis and in estimating the prognosis.

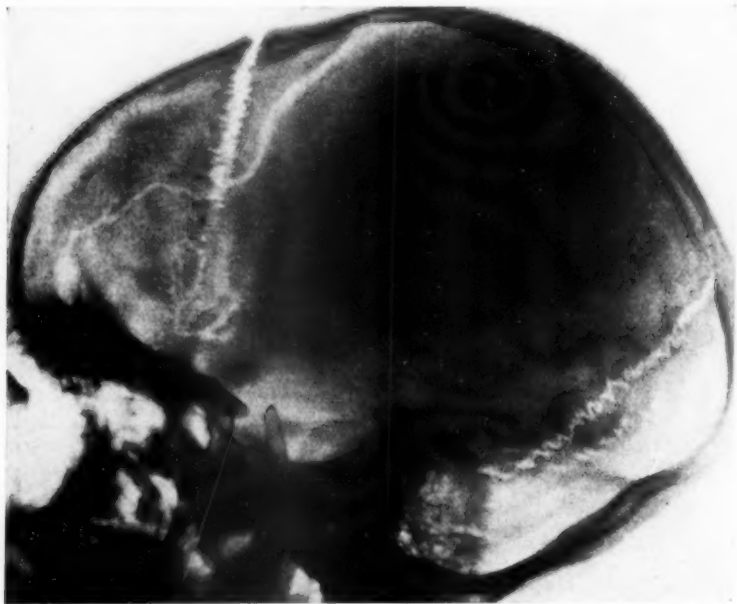


FIGURE II. Right lateral radiogram of the skull of a boy, aged twelve, showing separation of the coronal and lambdoidal sutures. The *sella turcica* and clinoid processes are normal, and there is no convolutional thinning of the skull. At operation a condition of chronic basal arachnoiditis was found.

Localizing signs will be considered in the following order: (i) Calcification. (ii) Erosion of bone and hyperostosis. (iii) Increased meningeal irrigation. (iv) Lateral shift of the pineal gland. (v) Ventriculographic signs.

#### Calcification.

Calcification occurs in about 20% of intracranial tumours, being most frequent in cranio-pharyngeal pouch cysts (about 70%),<sup>(1)</sup> oligodendrogliomas (about 50%), and meningiomas (about 15%). Of all the gliomas, only about 10%<sup>(2)</sup> show calcareous deposits. Calcification also occurs sometimes in angiomas and in tumours of the chorioid plexus and in teratomatous dermoids. In cranio-pharyngeal pouch cysts

which manifest themselves most frequently in the second decade of life, the diagnosis is usually reasonably certain on clinical evidence, and the presence in addition of small suprasellar calcareous deposits makes the diagnosis positive (see Figure I).

Figures IV and VI demonstrate the type of calcification seen in oligodendrogliomas. These relatively uncommon types of gliomas grow very slowly, and in many cases are parietal in situation. Although they

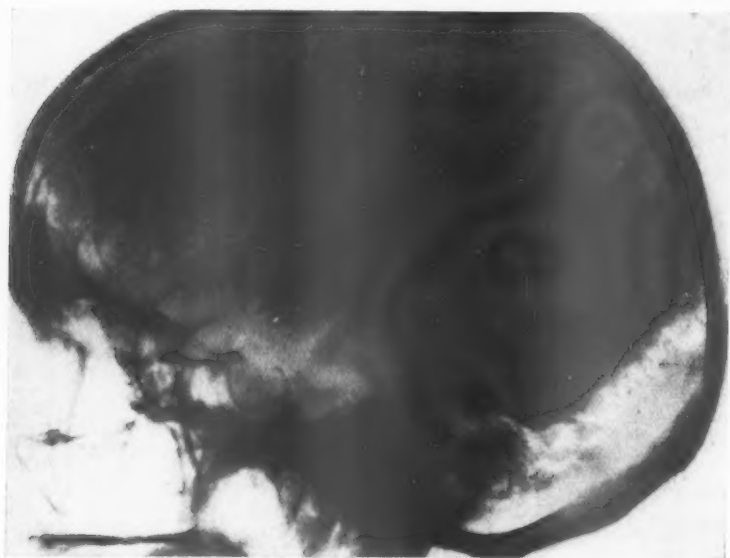


FIGURE III. Right lateral radiogram of the skull of an adult male suffering from a right cerebello-pontine meningioma. Here the increased intracranial pressure produced by the posterior fossa tumour has caused marked "ballooning" of the *sella turcica*.

are usually large tumours, their situation often renders them accessible and the ultimate prognosis is much better than in the malignant gliomas of the spongioblastoma type. The presence of calcification in a hemisphere tumour is therefore of first importance in forming a prognosis. Calcification occurs also in some astrocytomas, but these again are far less malignant than spongioblastomas. In Figures IV and VI the calcification is parietal in situation, is scattered and irregular, and small dense calcareous deposits separate areas of tumour quite free from calcification. In Figure VI the circumferential nature of the calcification is unusual, and the possibility of calcification in the wall of a chronic cerebral abscess or at the periphery of an old subdural hæmatoma had to be considered.

Figure VII shows diffuse calcification of a slowly growing parietal astrocytoma. In subtentorial tumours calcification is only rarely seen in some astrocytomas and haemangiomas.

#### Erosion of Bone and Hyperostosis.

Of erosion and hyperostosis, erosion is much more frequently apparent, and some degree of local erosion of bone is the rule in adenomas



FIGURE IV. Right lateral radiogram of the skull of a girl, aged nineteen, showing: A, scattered calcification in the right parietal lobe; B, slight separation of sutures; C, moderately "ballooned" sella. Diagnosis: Calcified right parietal glioma (oligodendroglioma).

of the pituitary gland. The reason for this is not far to seek in the confined bony boundaries of the *sella turcica*. Meningiomas in any situation, unless they are parasagittal, are liable to cause erosion of bone and secondary hyperostosis. In a radiogram, however, eroded areas quickly meet the eye, while small hyperostoses tend to blend with the general convolutional markings of the inner table of the skull. In rare cases a hyperostosis may overlie a meningioma and no erosion be apparent. If the clinical evidence of tumour is not definite in such a case and if no calcification is seen in the substance of the tumour, it is difficult to differentiate the radiographic appearance from that seen in

an ivory exostosis of the skull and ventriculography may be necessary to make the diagnosis absolute. Some degree of erosion usually occurs in meningiomas of the olfactory groove and the sphenoidal ridge where the dura is closely adherent to the bone.

In Figure VIII can be seen the typical changes produced in the *sella turcica* by a pituitary adenoma. This is a direct sella radiogram and was taken by focusing down a cone diaphragm against the end of

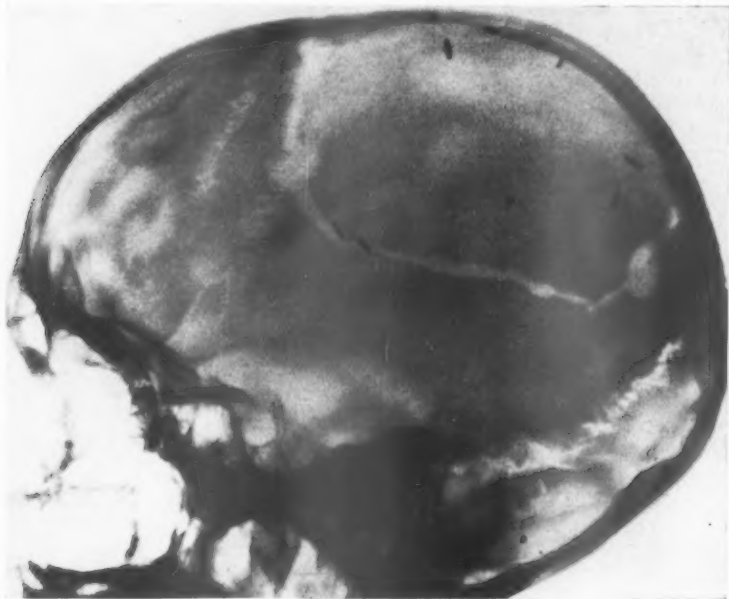


FIGURE V. Right lateral radiogram of the skull of the same patient as in Figure IV taken after partial removal of the tumour. This figure shows the site of the osteoplastic flap and hæmostatic silver clips in position. All calcified areas of the tumour have been removed.

which the lateral surface of the head was held apposed. The sella is larger than normal and the *dorsum sellæ* is irregularly eroded. The posterior clinoid processes are markedly eroded, and the gross uneven appearance of the anterior clinoid processes suggests that they have responded to pressure by hyperostosis. This radiogram contrasts with the "ballooned" sellæ of Figure III.

Erosion of bone is rarely seen in subtentorial tumours. Acoustic neuromas are known sometimes to cause erosion of the *porus acousticus*, but the density of the petrous part of the temporal bone renders such erosion extremely difficult to detect.

### Increased Meningeal Irrigation.

The arteriographic investigations of Moniz and Lima,<sup>(3)</sup> who used arterial injections of an opaque thorium preparation, "Thorotrast", have shown that in the majority of intracranial tumours there is either marked vascular irrigation of the tumour substance or venous congestion of the surrounding cerebral tissue or the overlying meninges. The arterial or venous changes in tumour or cerebral tissue may be detected only by



FIGURE VI. Right lateral radiogram of the skull of a boy, aged twelve, suffering from a calcified right parietal oligodendroglioma. Note the wide separation of sutures and the atypical circumferential nature of the calcification.

arteriography; if, however, venous congestion of meningeal vessels persists for some time, the adjacent bone is subjected to pressure and erosion takes place. The normal channels on the inner surface of the skull bones are then made deeper and wider, and are seen in radiograms as channels of rarefaction.

There is a considerable range of normal variation in the venous channels of skull bones; in some individuals no such channels may be detected by radiography, while in others they may be clearly seen in the absence of any intracranial abnormality. If they are well marked in normal individuals, they usually occur bilaterally and only one or two channels are evident on each side. In Figure IX several large venous channels are seen on the right side. No such channels appeared on the

left side. This patient had a very large parietal meningioma (220 grammes), which was removed completely at operation. As these tumours grow very slowly, this one had obviously been present for a long time, and the resulting increased meningeal venous congestion produced unilateral radiographic signs, which, coupled with the history and physical signs, enabled the tumour to be classified pathologically before it was exposed at operation. The subendosteal situation of these

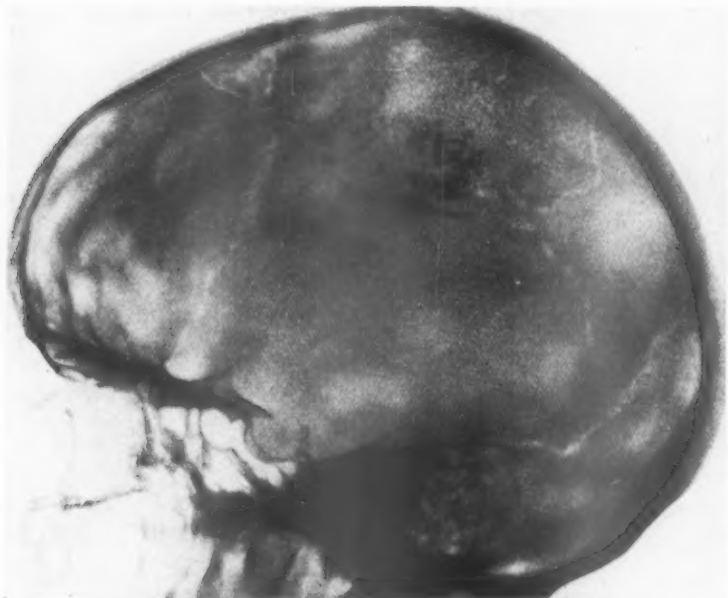


FIGURE VII. Right lateral radiogram of the skull of a woman, aged twenty-one, showing diffuse calcification in a right parietal astrocytoma.

tumours which arise from the endothelial cells on the outer surface of the arachnoid or inner surface of the dura, is particularly favourable for producing congestion of meningeal veins, and it may be said in general that, if the history and physical signs indicate an intracranial neoplasm and radiographic examination shows unilateral multiple venous channels, a diagnosis of meningioma may confidently be made.

This radiographic sign is by no means frequently seen. Of all intracranial neoplasms, only some 20% are constituted by meningiomas, and of these many are parasagittal in situation, while others are detected clinically when they are still too small to have produced any marked degree of meningeal venous congestion. When this sign is present, however, it is of great value in that the surgeon must be prepared to

remove a large and very vascular tumour and is able to give a good ultimate prognosis.

#### Lateral Shift of the Pineal Gland.

Lateral shift of the pineal gland is rarely seen, and is perhaps of less value than any of the preceding radiographic appearances. In about 60% of adults the pineal gland is sufficiently well calcified to be seen in stereoscopic radiograms. A large tumour in one cerebral hemisphere may displace the pineal gland from its situation in the middle towards



FIGURE VIII. Direct sella radiogram in a case of pituitary adenoma showing: A, enlarged sella; B, thin irregularly eroded dorsum sellae; C, thickened anterior clinoid processes; D, eroded posterior clinoid processes.

the opposite side of the skull. Fortuitous calcareous deposits in the falx, of no significance in themselves, provide similar indirect radiographic evidence when the falx is displaced from the mid-line by a hemisphere tumour.

#### Ventriculographic Signs.

The procedure of radiographic examination of the ventricular system following the injection of air was introduced by Dandy in 1918.<sup>(4)</sup> At first considered a dangerous procedure, it has now become safe in experienced hands, and has proved to be of great value both in the diagnosis of intracranial tumours and for the accurate localization of tumours which have been diagnosed by clinical examination. In a series of 70 verified intracranial tumours at the London Hospital, ventriculographic examination was performed in 16 cases, and in 12 of these definite

localizing evidence was found. It may be said that the cardinal principles of safe ventriculography are that it is never to be performed on comatose patients, on suspected posterior fossa tumours or in the presence of high papillædema, and that the neurological surgeon must be prepared either to remove the air or to operate immediately after satisfactory X ray pictures have been taken.

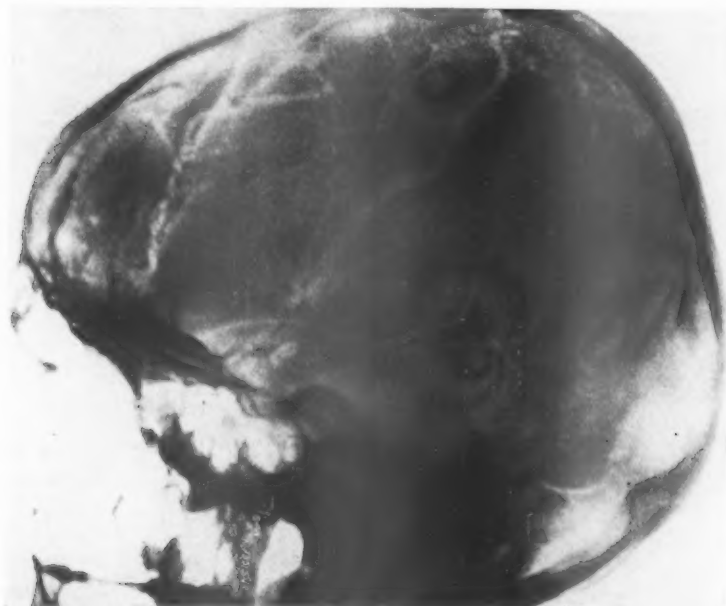


FIGURE IX. Right lateral radiogram of the skull of a man, aged thirty-four, showing greatly increased vascular irrigation on the right side. A large parietal and parasagittal meningioma was removed at operation.

Air may be introduced into the ventricular system either directly into one or both ventricles through a burr hole in the skull (ventriculography), or through the foramen of Magendie by injection of air into the spinal subarachnoid spaces (encephalography). The latter procedure is especially contraindicated in posterior fossa tumours, since the removal of spinal fluid will permit the *medulla oblongata* and cerebellar tonsils to be forced into the *foramen magnum* by the increased intracranial pressure above. In this manner a "pressure cone" is formed and respiratory failure may actually occur during the spinal injection of air. In some cases where an intracranial tumour has been diagnosed and its localization only suggested by clinical examination, particularly in hemisphere and parasagittal tumours, the injection of only five or ten

cubic centimetres of air into the lumbar subarachnoid space will often provide definite localizing evidence. After passing through the foramen of Magendie, this air reveals the position of the *septum lucidum* and the roofs of the lateral ventricles. This absolutely safe procedure, known as lumbar insufflation, is not usually followed by such ill effects as the nausea and vomiting which may succeed the introduction of some 90 or

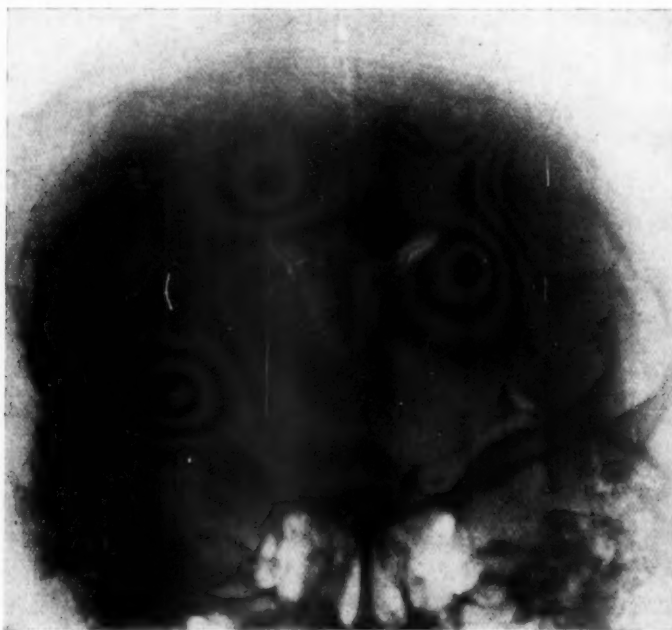


FIGURE X. Normal antero-posterior ventriculogram, showing the median position of the *septum lucidum* and the triangular contours of the anterior horns of the lateral ventricles.

100 cubic centimetres of air, as in encephalography. Provided that the foramen of Magendie is patent, there is never any difficulty with appropriate technique in passing five to ten cubic centimetres of air introduced by the lumbar route into the ventricular system, and, indeed, if no air reaches the ventricular system, there is evidence that the communications with the subarachnoid space have been interrupted and that a posterior fossa tumour is present.

#### *Normal Ventriculographic Appearances.*

In the radiographic examination of the ventricular system four stereoscopic views should be taken: occiput-to-film (antero-posterior), nose-to-film (postero-anterior) and right and left lateral. These may be

taken with the patient in the horizontal position, unless a small quantity of air has been injected—as in lumbar insufflation—when a vertical antero-posterior view is required to show the *septum lucidum* and the roofs of the lateral ventricles, and hyperextended and hyperflexed lateral views are taken in the horizontal position to reveal the outlines of the anterior and posterior cornua respectively. It is advisable for the neurological surgeon to supervise the manipulation of the head and to

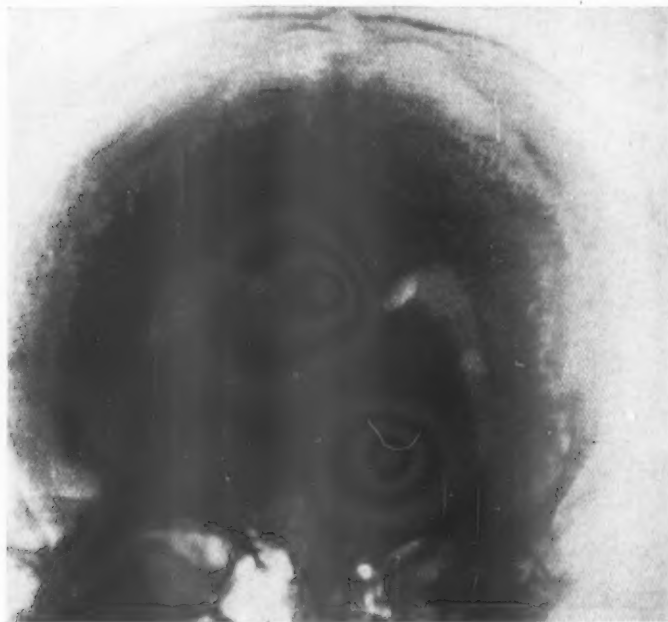


FIGURE XI. Normal postero-anterior ventriculogram, showing incomplete filling of the left occipital horn.

determine the order of the sequence of views, particularly if air has been introduced purposely into one lateral ventricle only. He may then direct the air to any region of the ventricular system which may be suspected to be distorted or displaced. The interpretation of ventriculograms is by no means a simple matter. Considerable experience and judgement are required and the correlation of the radiographic appearance with the clinical findings demands that the neurological surgeon, after injecting the air, should manipulate the head and cooperate with the radiologist in the interpretation of the ventriculograms.

The most common difficulty in interpreting ventriculograms is incomplete filling of the ventricles with air. In ventriculography as

a purely diagnostic procedure, as opposed to a localizing method, a balance must be struck between the introduction on the one hand of too much air and on the other of too little. If ventriculography is to be safe, some degree of incomplete filling of the ventricular system with air is the result. In the ventriculograms, then, one does not expect to see the complete outline of even the lateral ventricles, and the films may show apparent distortion of the ventricular walls in dependent regions where cerebro-spinal fluid has not been displaced by air. The

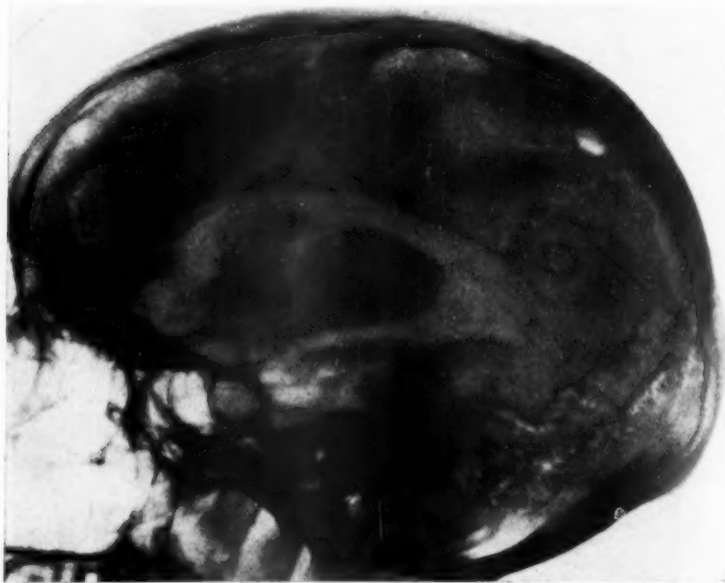


FIGURE XII. Normal right lateral ventriculogram.

knowledge of when and where this source of error is most likely to occur is essential for correct interpretation. The ventricular distortion produced by an intracranial neoplasm is, however, in nearly every case accompanied by some displacement of the *septum lucidum*. Films which show apparent distortion due to filling defects always reveal a *septum lucidum* in the normal mid-line position. The more particular difficulties of ventriculogram interpretation are too detailed to be considered here.

Antero-posterior, lateral and postero-anterior ventriculograms provide typical dissimilar appearances in a normal individual. Normal ventriculograms are shown in Figures X, XI and XII. In the antero-posterior view (Figure X) the *septum lucidum* is seen in the mid-line, the sagittal suture appearing to divide immediately above its upper end. The thickness of the *septum lucidum* is variable, and depends on the

extensity of the *cavum septi lucidi* lying between its laminae. On either side of the *septum lucidum* are the triangular symmetrical shadows of the anterior horns and anterior part of the bodies of the lateral ventricles. The whole picture presents the appearance of two isosceles triangles apposed in the mid-line with their bases directed downwards and outwards. It is to be noted that the roof of this part of the ventricular system is not horizontal, but inclines upwards and outwards on each

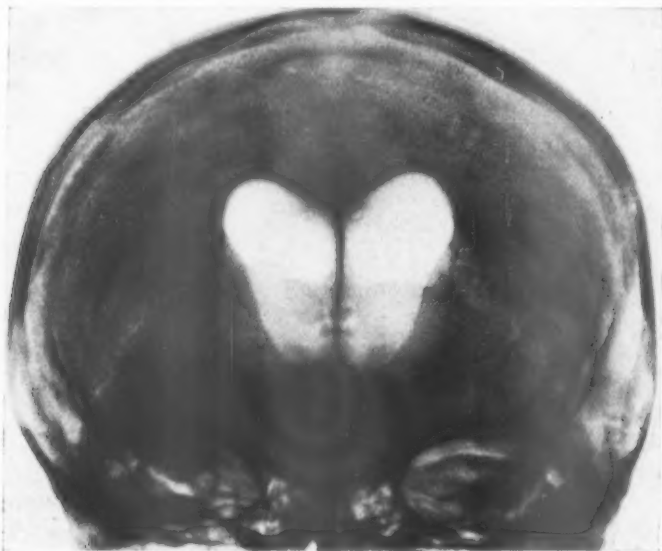


FIGURE XIII. Antero-posterior ventriculogram in a case of right cerebellar haemangioma showing bilateral symmetrical internal hydrocephalus. Note the median position of the *septum lucidum* and the complete filling of the bodies of the lateral ventricles.

side. The indefinite shadow below the triangles represents air in the third ventricle. It is difficult to outline this space satisfactorily, unless a considerable quantity of air is injected and special postural technique is adopted. Air in the temporal horns of the lateral ventricles may sometimes be seen near the inner and upper portion of the orbital margin.

In the postero-anterior view of the same patient (Figure XI) can be seen the shadows of the occipital horns of the lateral ventricles. The apparent asymmetry here is due to incomplete filling of the left occipital horn. Apparent distortion of the anterior end of these horns may be caused by the two variable ridges—the *calcar avis* and the *bulbus cornu posterioris*—on their infero-medial surfaces. True space-occupying lesions of this region, however, would cause the peripheral crescentic

visual field disturbance characteristic of impaired function of the anterior part of the calcarine area. Little comment is required on the lateral view (Figure XII), as it presents the typical appearance of the textbook cast of the lateral ventricles. The burr hole in the skull for the introduction of air and the incomplete filling of the occipital horns are clearly seen.

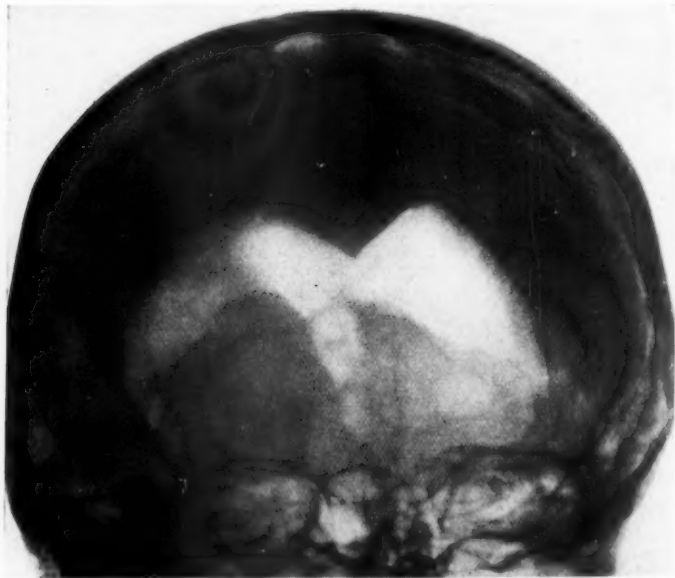


FIGURE XIV. Postero-anterior ventriculogram of the same patient as in Figure XIII.

#### *Bilateral Symmetrical Hydrocephalus.*

The gross changes which may occur in internal hydrocephalus are seen in Figures XIII, XIV and XV. These are ventriculograms of a case of right cerebellar hamangioma.

Ventriculography was performed by a Continental surgeon and the patient was then referred to the London Hospital. Although ventriculography was contraindicated by high papilloedema (four diopters) and by the presence of a posterior fossa tumour, it was nevertheless performed and a relatively enormous volume of air was injected (some 150 to 200 cubic centimetres). In spite of this the patient reached England, where the tumour was removed. A protracted post-operative hyperthermia followed, but the patient eventually recovered after his hazardous surgical adventure.

The picture here is one of bilateral symmetrical hydrocephalus characteristic of posterior fossa tumours. The *septum lucidum* is still

in the mid-line (Figure XIII), but the anterior parts of the lateral ventricles have lost their triangular outline and have become bulbous. The posterior horns are enormously dilated (Figure XIV), and the third ventricle seen in the lateral view (Figure XV) is completely filled with air. This film is a beautiful exposition of the third ventricle, showing the foramen of Monro, the *massa intermedia*, the optic recess, and the suprapineal and infrapineal recesses. With more enlightened technique one would have been satisfied merely to draw off some fluid from each dilated lateral ventricle, and, realizing that a condition of bilateral

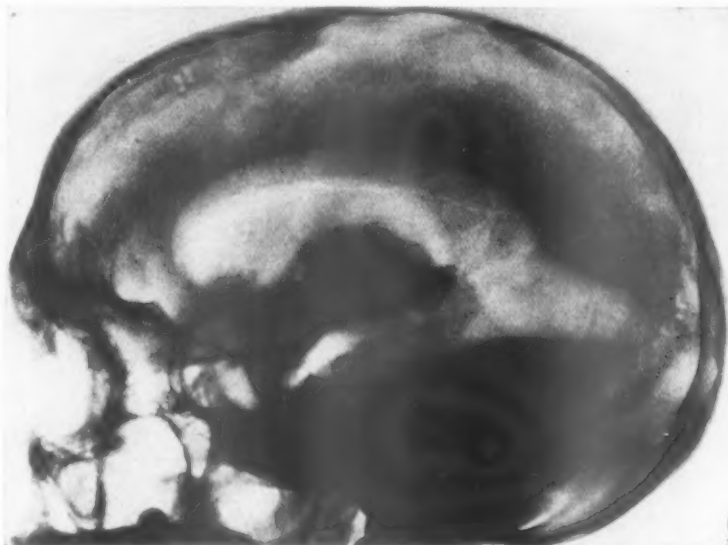


FIGURE XV. Right lateral ventriculogram of the same patient as in Figure XIII. Note the completely filled third ventricle lying between the bodies and temporal horns of the lateral ventricle. The *sella turcica* shows advanced "ballooning".

symmetrical hydrocephalus was present, would have proceeded with a cerebellar craniotomy.

Bilateral symmetrical hydrocephalus is the characteristic ventriculographic appearance when obstruction is offered to the free passage of cerebro-spinal fluid in any part of the ventricular system caudal to the upper end of the aqueduct of Sylvius. Neoplastic lesions which would be expected to produce this type of internal hydrocephalus are:

1. Pedunculated cystic or solid tumours of the third ventricle acting as ball valves over the superior aperture of the aqueduct.
2. Gliomas of the mid-brain and pons.
3. Ependymomas of the fourth ventricle occluding the foramina of Magendie and of Luschka.

4. Papillomas of the fourth ventricle.
5. Gliomas of the cerebellar vermis.
6. Any large cerebellar or extracerebellar tumour appropriately placed to interrupt communication between the fourth ventricle and the subarachnoid spaces.



FIGURE XVI. Antero-posterior encephalogram of a patient suffering from a small left parasagittal meningioma, showing: A, deviation of the *septum lucidum* to the right; B, left ventricle smaller than the right; C, flattening of the roof of the left ventricle.

#### *Ventricular Asymmetry.*

Tumours which produce obstruction in the region of one foramen of Monro provide a definite contrast to the foregoing. There the ventriculograms will show a large lateral ventricle on the side of the lesion with a ventricle of normal size on the opposite side, while the *septum lucidum* will be displaced by unbalanced pressure towards the normal side. In some cases this pressure is sufficient actually to tear the septum and the resulting hole serves to permit the fluid to pass across to the opposite lateral ventricle and through the patent foramen of Monro into

the third ventricle. As the tumour increases in size the patent foramen may be occluded and both ventricles become dilated. It is of value to remember that if one foramen of Monro is occluded, air introduced into one lateral ventricle cannot be manipulated across to the opposite side unless the septum is torn. If both foramina are occluded, air introduced into the lumbar subarachnoid sac cannot reach either lateral ventricle.

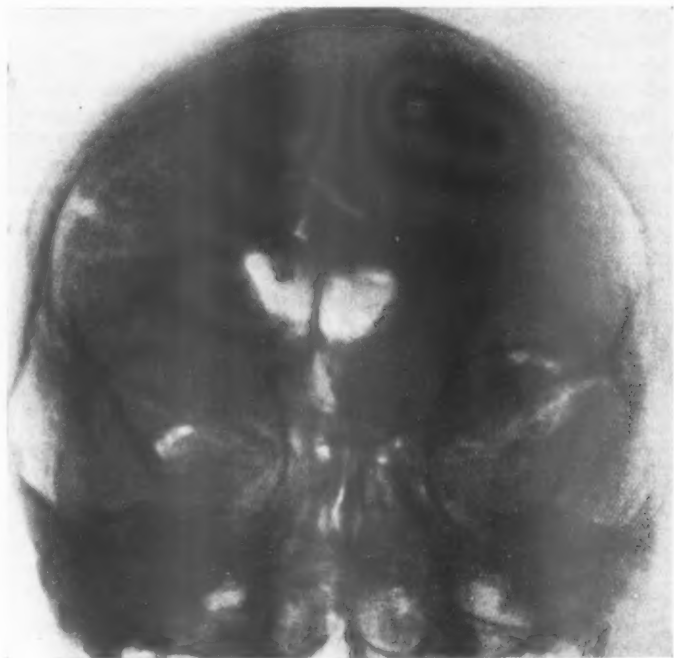


FIGURE XVII. Antero-posterior encephalogram of a patient suffering from an arachnoid cyst in the region of the left frontal adersive field. There is marked displacement of the *septum lucidum* to the right and downward displacement of the left ventricle.

In hemisphere tumours, whether extracerebral or intracerebral, the object of ventriculography is to determine the position of the *septum lucidum* and to examine the size, shape and position of the lateral ventricles. Owing to the relatively "silent" nature of the regions in which they arise, prefrontal, parasagittal and postparietal tumours are those which most frequently call for ventriculographic examination. Temporal and occipital tumours generally provide localizing defects in the visual fields. The former may require ventriculography for their localization, but owing to the small size and dependent situation of the inferior

horns of the lateral ventricles, the localization of temporal tumours by ventriculography is difficult and rests mainly perhaps on slight displacement of the *septum lucidum* towards the opposite side, and on the fact that no evidence of frontal or parietal tumour has been detected. In temporal lobe tumours, although the ventriculograms may appear normal, the removal of cerebro-spinal fluid sometimes causes shifting of the neoplasm, with the result that some hours after ventriculography fresh objective signs, such as nominal aphasia or homonymous visual field defects, may appear and localize the tumour in one cerebral hemisphere or the other. Paracentral tumours situated in the neighbourhood of the anterior central gyrus seldom require ventriculography for their diagnosis or localization. The localization of lesions in this situation is certain on the evidence of subjective or objective weakness with or without a history of focal epileptic attacks succeeded by Todd's paralysis. In some cases in which the tumour is very small and before the development of papillædema, ventriculography may be required to differentiate between neoplasm on the one hand and focal epilepsy succeeding some unrecorded cerebral trauma on the other.

#### CASE REPORT.

R.H., a male patient, aged thirty-one years, was admitted to the London Hospital on October 11, 1932, complaining of recurrent attacks of twitching of the right foot and leg succeeded by unconsciousness. There was no family history of epilepsy and no history of cerebral trauma. The present illness commenced two years previously while he was driving a motor-car. His right foot suddenly felt stiff, the foot and leg commenced to twitch and he became unconscious. He had had twenty-three such attacks in the past two years. He had never been incontinent, but had bitten his tongue in several nocturnal attacks. Recently the twitching had involved the right thigh and the attacks were succeeded by weakness of the right leg. Headache and malaise followed each attack. As a civil servant he had been completely incapacitated by this illness.

On examination the patient was a healthy looking, muscular young man. There was no abnormal configuration of the skull and no intracranial bruits were present. The optic discs were normal; there were no visual field defects and the cranial nerves were all intact. The right foot was colder and paler than the left. There was weakness of plantar flexion and dorsiflexion at the right ankle. Unsustained clonus was present at the right ankle. The right plantar response was sometimes equivocal. The abdominal reflexes were normal and there was no interference with superficial or deep sensation. There were no other abnormal physical signs. Radiograms of the skull displayed no abnormality. Encephalography was performed by withdrawing 105 cubic centimetres of cerebro-spinal fluid from the lumbar sac and injecting 100 cubic centimetres of air. This procedure was following by considerable cerebral discomfort and retching. The encephalograms (Figure XVI) showed marked downward displacement of the left lateral ventricle, which was smaller than the right. There was slight displacement of the ventricles to the right, the uppermost part of the *septum lucidum* being deviated to the right.

At operation a small parasagittal meningioma weighing 10 grammes was removed from the region of the right leg motor area. The patient recovered completely and resumed his occupation.

In this case the localization of the lesion had never been in doubt, but the encephalograms, by demonstrating the presence of a space-occupying lesion on the left side, proved that the cause of the focal

epileptic attacks was an intracranial neoplasm. It is interesting to note the definite distortion and displacement of the ventricles which may be produced by so small a tumour.

Figure XVII is an encephalogram of a similar type of case.

This occurred in a middle-aged woman who had been suffering from left frontal adverse field attacks (five) with rotation of the head and eyes to the right, succeeded by unconsciousness. Encephalography revealed displacement of the *septum lucidum* to the right and downward displacement of the left ventricle. At operation a large arachnoid cyst was evacuated in the region of the left frontal adverse field.

Here again the localization of the lesion was obvious, but its space-occupying character was confirmed by encephalography.

The selection of the cerebral or lumbar routes should be carefully considered before the introduction of air, and the complete case should be reviewed before a choice is made. Each method has its merits and its risks, but it is considered that their more extensive use will provide in many patients information invaluable to the surgeon. Provided that there are no absolute contraindications, air should always be introduced into the ventricular system by one route or the other before a patient is submitted to craniotomy, if the diagnosis or localization of an intracranial tumour is at all uncertain.

#### CONCLUSION.

In conclusion I quote Cairns, who states:<sup>(6)</sup>

X ray examination of the skull is indispensable. In the investigation of a suspected case of intracranial tumour there are always three questions to be answered: (1) Is there a tumour? If so, (2) Where is the tumour? (3) What is its nature? Experience shows that radiography not infrequently plays the most important part in answering one or all of these questions.

#### ACKNOWLEDGEMENT.

I am indebted to Mr. Hugh Cairns, F.R.C.S., of the London Hospital, for permission to make copies and to publish radiograms of cases in his unit. Any opinions in this article or statements unaccompanied by references are my own.

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## RENAL TUBERCULOSIS: THE PROBLEM OF THE OTHER KIDNEY.

By R. CAMPBELL BEGG,  
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THE results of nephrectomy in unilateral renal tuberculosis have been so satisfactory that it should be carried out whenever possible. There are, however, cases in which considerable difficulty arises in making a decision. This problem involves two questions: (1) When, if ever, is it justifiable to remove one kidney, knowing that the other is tuberculous? (2) How can it be ascertained that the other kidney is definitely free from tuberculosis, and, if so, whether it is capable of supporting life in the absence of its fellow?

In regard to the first question, Caspar some years ago stated his opinion that in the presence of bilateral tuberculosis nephrectomy is justified: (a) when one kidney is little more than a sac of pus, and the other has good function and only a slight infection; (b) when there is severe and recurrent hæmorrhage from one kidney; (c) when there is persistent and agonizing pain in one kidney.

Keyes is a strong advocate of the removal of the more severely affected kidney, when the other retains satisfactory function. The removal of the badly affected kidney, he maintains, allows the painful tuberculous cystitis to improve or to recover, and thus alleviates the patient's suffering. A comparatively peaceful death occurs some years later from renal insufficiency.

The last two conditions stated by Caspar are too rarely encountered to attract much attention, and in bilateral renal tuberculosis there should be considerable deliberation even before removing the kidney which is totally destroyed. To illustrate this, I may quote the following case:

Recently, I examined a patient in whom symptoms and signs indicated that he had been suffering from renal tuberculosis for twenty years. Cystoscopy led me to believe that the left kidney was little more than a sac of pus. The functional activity of the right kidney, as judged by the specific gravity of the urine, and by the indigo-carmin test, was good. However, a little pus and some tubercle bacilli were found in a catheter specimen of the urine from the right kidney. It seemed rational to suppose that the vesical symptoms were mainly due to the pus from the left kidney, and that the indications for removing it were strong. However, for some reason, the operation was postponed, and the patient returned to his home, where, six weeks later, he died.

In cases such as these the expectation of life is not long, and the removal of the more diseased kidney does not necessarily lead to amelioration of the frequency, strangury, and pain on micturition. My experience would, therefore, lead me to believe that the removal of one kidney, when the other is known to have a focus of infection, is rarely advisable.

The more practical problem which usually confronts the urologist is to determine definitely: (a) that the other kidney is non-tuberculous; (b) that, alone, it is able to support life.

#### TUBERCULOUS INFECTION OF THE OTHER KIDNEY.

If a catheter specimen of urine taken from the kidney which is supposed to be healthy, is free from pus and shows good function, no further investigation is necessary, and the operation may be proceeded with at once. If the catheter specimen of urine contains a few leucocytes and no bacteria, or perhaps a few cocci or *Bacillus coli*, further examination is necessary. A conscientious and thorough search should be made for tubercle bacilli, and, if they are not found, two courses are open: either to remove the obviously diseased kidney; or to continue the investigation, catheterize the ureter and obtain a pyelogram. A guinea-pig test is of little value, because this animal is extremely sensitive, and a positive result may be due to the fact that the catheter has picked up a few bacilli in its passage through the bladder. Intravenous urography does not usually produce a pyelogram of sufficient detail to reveal a small tuberculous focus. Granulations or ulcers around the ureteric orifice revealed by cystoscopy cannot be relied on as criteria of infection of the corresponding kidney. One meets with cases in which this association has been noticed, and yet the kidney has been found to be quite healthy. A retrograde pyelogram is, therefore, the only investigation upon which reliance can be placed, and even this, in the early stage of a tuberculous kidney, may leave one entirely in doubt.

Another problem arises in assessing disease of the other kidney when the ureteral catheter specimen contains an occasional tubercle bacillus, but no pus, and when function is unimpaired. In these circumstances it is difficult to exclude the possibility of the presence of tuberculous infection of the second kidney. The discovery of one or two bacilli on an ordinary smear is too rich a find to be accounted for by contamination, especially if pus cells are present in addition. It may be that bacilli circulating in the blood from the diseased kidney or from a concealed focus in lungs or in bronchial lymphatic glands have been excreted by the sound kidney. In such circumstances, therefore, it is necessary, before resorting to operation, to make a careful examination by X rays and other methods, in order that any possible focus of tuberculosis in any other part of the body may be detected. A pyelogram of the other kidney should also be obtained and, even if the calyces appear normal, it is better to wait and to repeat the investigation. In

the majority of such cases a bilateral infection will be proved to exist with a very small focus in the healthier kidney.

If both a few pus cells and tubercle bacilli are found in the specimen from the other kidney, there is no doubt that one is dealing with bilateral tuberculosis, and the patient must be treated on this basis.

#### INSUFFICIENCY OF THE NON-TUBERCULOUS KIDNEY.

In renal tuberculosis, a routine retrograde pyelogram will in many cases show that the non-infected kidney exhibits distinct evidence of hydronephrosis, even where the usual functional tests are satisfactory. This is not a contraindication for nephrectomy. This hydronephrosis of slight or even advanced degree usually occurs when there has been considerable urinary disturbance, especially when the bladder is very contracted and there is intense frequency of micturition. It is probably due to physiological dysfunction in the mechanism of urinary peristalsis. This is well illustrated by the pyelogram obtained by the intravenous method.

This patient had had a nephrotomy performed, five years ago, for an abscess of the kidney. As the tuberculous nature of the condition was not recognized, a sinus had persisted for five years. On examination, it was found that the bladder as a receptacle had ceased to exist, and that the urine dribbled away into a urinal. Cystoscopy was obviously impossible. The intravenous medium appeared in the left kidney in a few minutes, and not at all in the right or infected kidney. The urea concentration of the total urine, that is, of the urine from the secreting kidney, was over 2% at the end of the second hour. Nephrectomy was performed. The patient was well one year later. The pyelogram of the remaining kidney showed uniform dilatation of the calyces, but no local deformation or destruction of kidney substance. Tubercle bacilli were absent from the urine after nephrectomy was performed.

In relation to the question of insufficiency of the other kidney, it is well to remember that, in cases of infantile kidney, the indigo-carmin test may be fallacious; the dye may appear in the normal time, and yet the kidney alone may be incapable of maintaining life.

#### CASES IN WHICH TUBERCLE BACILLI ARE FOUND IN THE URINE, BUT IN WHICH, BECAUSE OF A VERY CONTRACTED BLADDER, THE URETERS CANNOT BE CATHETERIZED.

When tubercle bacilli are found in the urine, but when, because of a contracted bladder, the ureters cannot be catheterized, it is unnecessary to review all the methods which have been employed:

1. The bladder has been opened and catheterization of the ureters has been attempted through the open bladder. This, however, has frequently been found to be impossible, and, furthermore, the wound in the bladder fails to close, so that a permanent fistula results.

2. One ureter has been exposed (or even both), to see if it was infiltrated. This has been as fallacious as the attempt to diagnose, by palpation or inspection, whether the kidney exposed at operation was tuberculous.

3. Attempts have been made to secure specimens of urine by bilateral operation. This is a more dangerous operation than nephrectomy, and has frequently failed to determine which kidney was tuberculous.

In cases such as these, when tubercle bacilli and pus are present in the urine and gross genital tuberculosis is absent, it is reasonable to presume that one, at least, of the kidneys is seriously involved. If the result of the urea concentration test of the urine be satisfactory, it means that the function of one kidney is good, better, indeed, than the test would appear to indicate; for this is a test, not of the quantity of urea excreted, but of its concentration, and the diluted urine from the diseased kidney should reduce the level of concentration.

One of the best methods at our disposal, when difficulty is experienced in diagnosing the state of the other kidney, is the intravenous use of "Abrodil", "Tenebryl" or "Uroselectan B". This will show which is the more active kidney, and the pyelogram will, at least, indicate whether there is a definite tuberculous focus in the presumably sound kidney. In these cases it is safer to proceed to nephrectomy. It is true that an occasional mistake will be made, and that we may, in fact, be operating on a patient with bilateral renal tuberculosis. This method, however, gives a far larger percentage of patients a chance of recovery than when we depend on extensive diagnostic operations, carried out without knowing whether we are dealing with a bilateral condition or not, and with the prospect of the second severe operation of nephrectomy still to come. Every urologist is almost bound to operate accidentally in an occasional bilateral infection, and it is better to do this than to refuse on insufficient grounds to operate in cases which, in all probability, the infection is unilateral; otherwise, we deprive many patients of the great benefit of operation, because we try to make absolutely certain that the other kidney is in no way involved.


The urinary findings in the case of the following patient will serve to illustrate how very difficult is the problem of the treatment of renal tuberculosis.

In the urine from the bladder, pus and tubercle bacilli were present. In the ureteral catheter specimens pus and tubercle were found in the urine from the right side, and there was some loss of the functional capacity of the kidney; in the specimen from the left side there were a few leucocytes, but no tubercle bacilli. The urine from the left kidney was injected into a guinea-pig, and a positive result was obtained. Notwithstanding this, the right kidney was removed. Three months after the operation the patient was examined and found to be free of symptoms, and repeated tests from time to time over a period of six years have failed to demonstrate either pus or tubercle bacilli in the urine.

In conclusion, it should be mentioned that the value of the guinea-pig test, even with regard to the presence of tuberculosis, should not be over-estimated. It has been asserted that there is one form of human tuberculosis which is pathological to man and to which guinea-pigs are immune—so-called *Bacillus tuberculosis gallinaceus*. It is certain that tuberculosis, prevalent among guinea-pigs, may make a positive result

of a test fallacious, while the delay in the findings is, in any case, a serious matter. It is more than doubtful whether in any but the very smallest percentage of cases this test is of help when ordinary urological, bacteriological and X ray examinations have failed.

#### SUMMARY.

1. In bilateral renal tuberculosis, nephrectomy is rarely indicated.
  2. The difficulties and the methods of determining the presence of tuberculous infection in the other kidney are discussed.
  3. It is occasionally better to remove the obviously tuberculous kidney than to wait until conclusive evidence is produced that the other kidney is free from disease.
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## HÆMANGIOBLASTOMATOUS CYSTS OF THE RETINA.

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At the meeting of the New Zealand Fellows of the Royal Australasian College of Surgeons held in Wellington in 1932, I presented a case of von Hippel's Disease or hæmangioblastoma of the retina. The case was shown, firstly, because the disease is rare, and, secondly, to draw attention to the important fact that von Hippel's disease is frequently associated with hæmangioblastomatous cysts of the brain and cysts in the kidneys, pancreas, liver, adrenals and epididymis. This association of hæmangioblastomatous cysts of the brain and retina with cysts in the liver and pancreas *et cetera*, goes under the name of Lindau's syndrome. Some few months later the patient presented himself with all the signs of increased intracranial pressure and a hæmangioblastomatous cyst of the cerebellum was successfully removed. This case is worthy of record because of the rarity of the disease, and is also interesting because it was reported originally to draw attention to the possibility of the patient at some future date presenting himself with a hæmangioblastomatous cyst of his brain: within a few months this actually happened.

### HISTORICAL.

Fuchs<sup>(1)</sup> in 1882, Darier in 1890 and Wood in 1892 described conditions which in those days were confused with arterio-venous aneurysms of the retina. Treacher Collins<sup>(2)</sup> in 1894 described the pathological appearances of three eyes removed from a brother and sister. He described these three eyes as showing different stages of what was evidently a familial affection resulting in rapid and complete destruction of sight. He described in all a plexus of thin-walled capillary blood vessels which he recognized as having begun in the retina. He also described some cells lying between the capillary vessels, but of the true nature of these cells he was not aware. Because of the reactive gliosis, connective tissue proliferation, cyst formation, retinal hæmorrhages and exudate, and detachment of the retina, for some years the disease was confused with Coat's exudative retinitis. In 1911 von Hippel described the pathological appearances of an eye removed for absolute glaucoma sixteen years after the onset of the disease. He concluded that the condition was an angiomatosis of the retina. Up till 1931 some 70 cases of the disease had been recorded. In 1926 Lindau drew attention

to the association of hæmangioblastomatous cysts of the retina with hæmangioblastomatous cysts of the brain and spinal cord and cysts of the pancreas, liver *et cetera*. Cushing and Bailey in 1928 published a paper in which they divided vascular tumours of the nervous system into two main groups, namely, (i) angiomatic malformations, (ii) the hæmangioblastomata or true neoplasms of blood vessel elements.

The angiomatic malformations have invariably traces of nervous tissue between the vascular loops. They are interesting from an ophthalmological point of view because they are often associated with buphthalmos (or congenital glaucoma) and facial nævi on the same side as the brain lesion. As the case to be recorded comes under Cushing's classification of hæmangioblastomata, it is not proposed to say anything further about angiomatic malformations.

#### CLINICAL MANIFESTATIONS.

I propose to deal with the disease in a general manner, and then more particularly with the condition as it is found in the eye.

Because Lindau first drew attention to the association of hæmangioblastomatous cysts of the brain and spinal cord with hæmangioblastomatous cysts of the retina and cysts of the liver, kidneys *et cetera*, the disease is usually associated with his name. This is rather misleading, as the complete picture rarely occurs. In some cases the patient may have a hæmangioblastomatous cyst of the brain *plus* a polycystic kidney, but no lesions of the retina. In another, there may be simply a hæmangioblastomatous cyst of the brain or spinal cord and no other lesions. In yet others there may be hæmangioblastomatous cysts of the brain and retina. All these various conditions are called Lindau's disease. If a hæmangioblastoma occurs in the retina alone it is called von Hippel's disease. It would cause much less confusion if we spoke of hæmangioblastomata of the particular organ or organs in which they happen to occur in the particular case with which we are dealing at the time.

Lindau states that the disease is familial in 20% of cases, and instances are known in which it has affected three generations. In the history of my patient it is interesting to note that some years ago a sister had one kidney removed for polycystic disease. I very carefully searched this young woman's fundi, but failed to find any evidences of hæmangioblastoma of the retina. I have also inquired carefully into the patient's family history, and can get no history suggesting eye trouble.

Of cases of hæmangioblastomata of the retina, 25% have also associated hæmangioblastomata of the brain. The disease, except in the very late stages, is easily diagnosed in the eye. This being the case, should the patient at a later date present himself with signs and symptoms of a brain tumour, a very useful clue as to the possible pathological nature of the brain lesion can be brought to our aid. Lindau stated in 1930 that Møller's case was the first as far as he knew in which a pre-operative pathological diagnosis of the brain lesion was made simply because the patient was known to have a hæmangio-

blastomata of the retina. In my own case, which, as far as I am aware, is the second to be recorded, a pre-operative pathological diagnosis could also be assumed. All patients with suspected brain tumour should therefore have their fundi well searched not only for papillœdema, but also for hæmangioblastomata. All patients with hæmangioblastomata of the retina should also have careful and repeated examination of the central nervous system.

These cases may appear at any time from the second decade onwards. My own case was 16 years of age.

Hæmangioblastomata of the retina appear to be more common in males than in females. Frenkel<sup>(4)</sup> in a study of twenty cases found fifteen in males and five in females. The lesions are frequently multiple.

#### HÆMANGIOBLASTOMA OF THE RETINA.

The patient usually presents himself complaining of failing vision. Darier says that epistaxis, cephalgia and dazzling before the eyes are premonitory symptoms, but most of the cases reported seem to show that the visual defect comes on insidiously. In the case to be recorded the patient simply complained that he was unable to see out of his left eye. So far, he has made no complaint about his right eye. In most cases the disease progresses to absolute blindness, usually with secondary glaucoma, which in a great number requires enucleation of the eye. Sufficient cases have not been reported to be able to give any idea as to how long it takes after the disease first appears to progress to complete blindness. Treacher Collins<sup>(5)</sup> reports a case which he watched for six years. He did not see the patient for another ten years, and she was then blind in both eyes. It seems that once detachment of the retina begins, complete blindness soon results. If it is true that most of the detachments are due to the increasing size of the cyst, then we could say that once cyst formation begins, the condition progresses rapidly. This is a point on which I am not at all sure. The same occurs in the brain. It is the size of the cyst which in most cases causes the increase in intracranial pressure. In my patient there was a detachment of the retina when the patient was first seen, and during the next four months the condition advanced very rapidly, causing an almost complete detachment of the retina.

On ophthalmoscopic examination the disease in the early stages is characterized by one or more round reddish tumours, with which one or more greatly enlarged and tortuous arteries and veins communicate. The enlarged artery appears to enter the mass on one side and the enlarged vein leaves it on the other side. Treacher Collins states:

Though in some cases only one swollen area is present and one companion artery and vein are dilated, it has been shown by von Hippel and Paton that in cases watched over a long period, fresh balloon-like swellings may develop in different parts of the fundus, the vessels leading to them becoming enlarged and tortuous. Such observations throw doubt on the congenital nature of these growths, but Lindau has shown the presence of an angioblastoma in the retina of microscopic size which would escape detection ophthalmoscopically.

In my case the right eye also showed a small round reddish nodule with a large artery and vein entering it on the temporal side of the fundus. Some of the inferior arteries and veins were also enlarged and tortuous, although no nodule could be seen. It has been stated that the vessels do not enlarge or become tortuous until the tumour appears; they become larger and more tortuous as the tumour increases in size, but in this case there was marked enlargement and tortuosity of some of the vessels with no ophthalmoscopic evidence of a tumour (although, as Lindau states, a microscopic lesion may have been present). But even if a microscopic lesion were present, it seems strange that such a small lesion should require the presence of such large and tortuous vessels. It almost looks as if the enlargement of the arteries and veins were also part of the general condition. Also, in the left eye there were one or two enlarged and tortuous vessels which did not appear to be connected with any tumour, although such a tumour may possibly have been covered by part of the detachment.

After the tumour has been present for some time, it begins to produce a cyst which is thought to cause the detachment of the retina. The tumour forms part of the cyst wall and is frequently found in one corner of the cyst. The growth being composed of thin-walled capillaries, gives rise to repeated hæmorrhages, which appear first in the retina and may then break through into the vitreous, or if they break through the external limiting membrane, they may appear between the retina and chorioid. Numerous exudates appear in the layers of the retina. Eventually a condition of *retinitis proliferans* may be set up, and this may act as a cause of the detachment. Blood between the retina and chorioid may also form fibrous tissue, and it is believed that it is this fibrous tissue which gives rise to the white plaques which are seen in so many of these cases. The cysts usually increase in size until eventually the retina is completely detached.

Hæmangioblastomata of the brain occur chiefly in the cerebellum and medulla. Lindau stated at the end of 1930 that up to that date no case of hæmangioblastoma of the cerebral hemispheres had been reported, although during the last few months several have been reported in the temporal lobe.

#### *Pathology.*

The pathological appearances of hæmangioblastomata of the retina are exactly similar to those found in the brain.

The hæmangioblastomata are mesoblastic in origin. They are usually reddish or vascular looking, but a great number of them have a distinctly yellow colour caused by the lipoid infiltration of the tumour. They may be solid in nature, but the great majority are cystic. The cyst may be situated in the centre of the growth, but in most cases there is a single large solitary cyst with a small hæmangioblastomatous nodule in one wall. The blood vessel elements in the growth have a marked tendency to form vascular channels and spaces, but between these vascular channels there is a great deal of intercapillary tissue which

contains many fat-laden endothelial cells. In some cases the growth is composed of almost all endothelial cells and few vascular channels, while in other cases there are many vascular channels and few endothelial cells. There are all gradations between these two extremes. When many endothelial cells are present the diagnosis is difficult, especially from glioma. In most cases the intercapillary tissue contains a lot of fat-laden endothelial cells called xanthomatous cells, and it is these which cause the yellow colour. The hæmangioblastomata have a high exudative power, and it is this exudate which causes the cyst formation. The surrounding nervous tissue seems to be unable to get rid of this exudate, which slowly pushes the nervous tissue aside, and thus forms the cyst.

Lindau does not state very definitely the type of lesion found in the kidneys and liver *et cetera*, beyond stating that they are not hæmangiomas in nature. Boyd, in his latest book, "Pathology of Internal Diseases", also has little to say on the matter. The kidney removed from this boy's sister was an ordinary congenital polycystic kidney. The condition seems more in the nature of an association of one type of congenital lesion with another.

#### CASE REPORT.

On August 12, 1932, C.F.D., a healthy lad of sixteen years, was referred to me because of failure of vision in his left eye. Four months previously he had spent some days in bed with headache, vomiting and dizziness. The headache and vomiting had followed a slight injury received while playing football, and he had been treated for a head injury.

On examination the vision of the right eye was  $\frac{6}{6}$ ; the vision of the left eye was perception of light in parts of the field.

*Left Eye.*—The disk edges of the left eye were obscured by exudate. There was a very large temporo-inferior detachment of the retina. At the distal edge of the inferior detachment there was a fairly extensive tear in the retina. Both the detachment and the normal retina had numerous small white spots scattered over them. There were also numerous large areas of exudates and scattered hæmorrhages. The arteries and veins running to the temporo-inferior part of the fundus were very tortuous and dilated. Situated on the inferior detachment were two rounded red masses. Opening into each side of these was an enlarged and tortuous blood vessel. There seemed to be a difference in my case from those already recorded in that, instead of a vein passing to one side and an artery to the other side of the red mass, a greatly enlarged artery approached the mass and just before reaching it broke up into two branches, one passing to each side of the mass. There was much exudate covering the greatly enlarged vessels and the bifurcation took place just at the edge of the detachment, so it would have been possible to make a mistake. Nevertheless, I feel sure that my observation was correct. At the second red mass an artery distinctly went to one side and a vein to the other. There did not appear to be any red mass in relation with the vessels which went to the temporal detachment, although one may easily have been so situated that it was covered by the detached retina. In this eye there was no mistaking the greatly enlarged and tortuous vessels: they were immediately apparent.

Some four months later the retina in this eye was completely detached.

*Right Eye.*—In the right eye there were also enlarged and tortuous arteries and veins in the infero-temporal part of the fundus. They were not as large as those in the left eye, but they nevertheless were very obvious. In the extreme periphery of the temporal fundus an artery and vein embraced and opened into a

small round red mass. No similar mass could be seen in any other part of this fundus, although the vessels running to its lower part were much enlarged and tortuous.

I saw the boy again on December 18, 1933. In the left eye the completely detached retina could be seen lying just behind the lens. Coursing over this retina there were several enlarged and tortuous vessels, which could be seen easily with the naked eye. They could not be seen some months previously. So far he was not complaining of any pain in this eye.

In the right eye the condition had advanced very considerably. The nodule in the temporal part of the fundus was at least three times as large as when I first saw the patient. A definite cyst could be seen attached to the nodule, and there was a commencing detachment of the retina. In the inferior part of the fundus a definite nodule could now be seen lying between two enlarged and tortuous vessels. Although these were present when first I saw the patient, I am quite certain that no nodule could be seen with the ophthalmoscope.

I made a diagnosis of hæmangioblastoma of the retina and Dr. Harty confirmed my diagnosis. In view of the known association of hæmangioblastomata of the retina with hæmangioblastomata of the brain, I advised an examination by a physician. Dr. J. R. Boyd was good enough to see him for me. Although he thought that the two previous attacks of headache and vomiting possibly indicated some temporary increase in intracranial pressure, no lesion of the cerebellum could be demonstrated at that time.

At this stage the patient was shown at the association meeting. Four months later the patient presented himself at the Out-patient Department of the Wellington Hospital, where he was seen by Dr. I. M. Allen, who has kindly included a summary of his findings.

The patient was subsequently operated on by Dr. H. K. Corkill, and he has provided a short description of the operation.

#### The following report is by Dr. I. M. Allen:

This boy was referred to me on December 31, 1932, and was admitted to hospital the same day. He complained of headache and vomiting of two weeks' duration. Two years before he had had an attack of severe headache and vomiting for twenty-four hours; and in April, 1932, he had a similar attack with headache, vomiting and dizziness for four days. In March, 1932, he had been unable to see an electric light with the left eye. For two weeks he had felt dizzy on rising; had staggered to the right and left as he walked; and had severe headache from the frontal to the occipital region, at first in the morning and later throughout the whole day. The headache was aggravated by stooping, straining, vomiting and trying to read. From the first day nausea followed by severe and persistent vomiting had been associated with the headache.

The following positive findings were elicited during three detailed neurological examinations. Negative findings will not be recorded. The boy was mentally dulled and fatigued easily. He held his head erect, often retracted, explaining that this relieved his headache. He carried his head bent to the right with the occiput rotated to the right, the right shoulder lower than and in front of the left, and the right side of the chest rotated forward. Muscle tone was increased in the posterior neck muscles. Voluntary conjugate deviation of the eyeballs to the right was slightly impaired. Fine nystagmoid anti-clockwise movements appeared on deviation to the right, and to a lesser extent on deviation to the left and upwards. The left eye was blind. The pupils were dilated and equal; the right contracted briskly to direct light and convergence, but not to consensual light; and the left contracted to consensual light and convergence, but not to direct light. There was extensive detachment of the left retina; the right optic disk was swollen to four diopters, with distension of retinal veins and small patches of exudate; and a small angioma was observed to the temporal side of the right disk. The facial musculature was flabby and facial movements began slowly. There was slight diminution in muscle tone in the extensor muscles of the right upper limb; after prolonged movements some decomposition

of movements appeared; and on extending the upper limbs with the eyes closed spontaneous deviation of both upper limbs occurred, sometimes to the right and and up and sometimes to the right and down. On forcing the limbs down, the right recovered position more slowly than the left. There was slight diminution in the muscle power in the right lower limb; and muscle tone was slightly diminished in the dorsiflexors of the right foot. In eliciting the right knee jerk, there was a long latent period followed by a slow rise and a slow fall, whereas on the left side the limb rose at once and fell suddenly. Similar phenomena were observed with the ankle jerks. When standing, the patient swayed back, and when walking he staggered to the right and left, with a preponderance to the right. In all other respects the functions of the nervous system were normal.

The history and the rapidly increasing intracranial pressure were interpreted as evidence of acute internal hydrocephalus. Evidence of cerebellar dysfunction was very slight, and, as nothing could be assumed as to the position of the lesion, it was necessary to consider whether it was the common secondary cerebellar dysfunction due to increased pressure above the tentorium, that due to lesion of the cerebellum, or that due to a combination of both factors. It was decided that it was the result of a lesion of the cerebellum, and, in view of the presence of the retinal angioma, it was expected that there would be found a cyst of the cerebellum with a hæmangioblastomatous mural nodule. Accordingly, exposure of the cerebellum was advised. The available evidence of cerebellar dysfunction showed a definite right-sided preponderance, but in the event it was shown that this was the result of a *contre-coup* effect in the production of physical signs not uncommon when pressure is rising rapidly in the intracranial compartment which contains the lesion.

The report by Dr. H. K. Corkill is as follows:

The patient was admitted for surgical treatment on December 31, 1932, after investigation by Dr. Hope-Robertson and Dr. Allen, having at that time well marked cerebellar symptoms and evidence of greatly increased intracranial tension.

Pre-operative treatment consisted of 15% hypertonic saline solution given intravenously on the two days preceding operation, and 30% saline solution followed by 10% calcium chloride solution immediately before the administration of the anæsthetic on January 3, 1933.

Under ether given intratracheally a bilateral suboccipital craniotomy was carried out, the crossbow incision being used. The posterior margin of the *foramen magnum* was removed, together with the arch of the atlas, as there was a well marked pressure cone. Ventricle puncture and slow emptying were done through a separate drill hole over the left occipital lobe, and the needle was left *in situ*.

The dura was opened freely over both cerebellar hemispheres, and large dilated vessels were observed coursing over the lateral surface of the left lobe. These were found to lead to a cherry-red tumour of the size of a walnut, which came to the surface on the lateral side of the left cerebellar lobe.

The tumour was of soft consistency, but a hollow needle encountered only a few cubic centimetres of fluid, the bulk of the mass being soft solid matter.

The dilated vessels leading to it were coagulated by diathermy, and the whole tumour together with a layer of cerebellar tissue was excised with the cutting current. The cavity was treated with Zenker's fluid, and a careful layer closure was performed, during which stage an intravenous transfusion of one pint of blood and one pint of normal saline solution was given. A large immobilizing crinoline dressing was applied.

Histological examination of the excised material showed it to be hæmangioblastomatous in nature.


Convalescence was rather stormy for the first three weeks, with high temperature and marked evidence of cerebellar dysfunction, but thereafter improvement was steady.

It was not for some weeks after the patient had been out of bed that he recovered his balance and steadiness of gait, but he has made continued progress during the past eight months, and, except for his ocular defects, remains fit and well.

#### SUMMARY.

1. A case of hæmangioblastoma of the retina is presented.
2. Attention is drawn to the known association of hæmangioblastoma of the retina with hæmangioblastoma of the brain.
3. In this case a pre-operative diagnosis of the pathological nature of the brain lesion could be assumed because the patient was known to have a hæmangioblastoma in each eye.
4. The successful removal of a hæmangioblastomatous cyst of the cerebellum is recorded.

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## Case Reports.

### AN INTRADURAL AND SACROCCYGEAL TUMOUR.

By JAMES A. JENKINS,

*Dunedin.*

TUMOURS arising in the anococcygeal region are not uncommon, and their classification clinically and pathologically is difficult and possibly often erroneous.

If one reviews the literature on these tumours, it becomes at once obvious that various investigators classify similar tumours in different ways, and that different embryological structures are suggested as the cause of any one particular kind of tumour.<sup>(1)</sup> This region is characterized by its developmental possibilities, and arising out of these are certain defined groups of tumours. These are:

1. Simple sequestration dermoids, such as may arise in any position in the body where there is a fusion of tissue planes. Pilonidal cysts and sinuses may reasonably be included under this heading.<sup>(2)</sup>

2. *Spina bifida* in any of its various forms may occur in the sacral region.

3. Teratomata resulting from the inclusion of primitive embryonic cells and characterized by a wide range of tissues should proclaim their nature on careful examination.

4. Fœtal relics are, by the majority of authors, looked upon as the cause of most of these tumours. These are:

- (a) Relics of the neurenteric canal. At a very early stage of embryonic life the central canal of the spinal cord connects with the hind gut round the posterior end of the notochord. That the upper part of the central canal which is later obliterated and represented by the *filum terminale*, may give rise to tumours and cysts is undoubted,<sup>(3)</sup> but it is impossible of proof that the neurenteric canal as such ever enters into the formation of these tumours. Recognition of the very short time this communication with the central canal of the cord exists in the embryo, and also its very small extent, makes it a very much less likely source of tumour than the *vestiges coccygiens* described below.

- (b) Relics of the post-anal gut. As the proctodeum deepens through the cloacal membrane to meet the hind gut, it passes anterior to the extremity of the gut and leaves a blind pouch which is known as the post-anal gut. The neurenteric canal is described as entering this pouch. There seems little doubt that this structure may give rise to tumours. Middeldorpf, after whom these tumours are frequently called, described the first case in detail, and in his tumour found mucous membrane with characteristic follicles, submucous tissue, and longitudinal and circular muscle fibres. Bland Sutton<sup>(4)</sup> states that they consist of closed vesicles lined with glandular epithelium containing glue-like orropy mucus. Cyst and duct-like passages are present and in many situations the epithelium is columnar. More recent observers<sup>(5) (6) (7) (8) (9)</sup> similarly consider that before a tumour is classified as being derived from the post-anal gut, certain evidence of intestinal origin can reasonably be demanded, such as columnar epithelium, goblet cells and reaction to mucicarmine stain.

- (c) Relics arising from the coccygeal body.

5. Tumours arising from the notochord—chordomata.

6. Tumours arising from the *vestiges coccygiens*. This structure apparently explains a big percentage of the cases reported in the literature, and there is little doubt that the case described below properly belongs to this group.

The following brief description by Kiebel and Mall<sup>(10)</sup> makes the origin of these tumours relatively simple:

The caudal end of the spinal cord exhibits certain departures from the uniform development characterising the rest of it, to which special attention may be directed. If one examines a sagittal series through an embryo 11 cm. long as shown in the figure (Figure I), it can be seen that the extreme tip of the cord lying in the tail anlage has been closed off to form a simple epithelial sac. The lumen of the cord above this point becomes obliterated, and there results a slender solid strand of nervous tissue which we know as the *filum terminale*. The epithelial sac becomes the *vestiges medullaires*

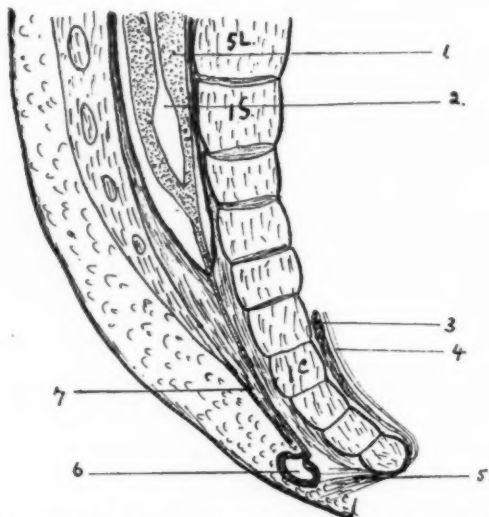


FIGURE I. Drawing taken from "Manual of Human Embriology", Kiebel and Mall, Volume II, page 57. 1 = *Conus medullaris*. 2 = *Ventricles terminalis*. 3 = *Sympathetic*. 4 = *Middle sacral artery*. 5 = *Ligamentum caudale*. 6 = *Vestiges coccygiens*. 7 = *Periosteum*.

*coccygiens* of Tourneux and Herrman, whose development is described by Tourneux (*Précis d'Embriologie Humain*, second edition, 1909, pp. 348, 349) as follows:

At the beginning of the third month the neural tube still extends to the extreme end of the vertebral column into the tail bud, and its slightly enlarged tip is closely united to the deeper layers of the skin. Towards the end of the third month the spinal column, developing faster than the soft parts, draws along the part of the tube that is adherent to it and whose extreme tip remains attached to the skin. As a result of the unequal growth, the terminal or coccygeal portion of the neural tube becomes bent in the form of a loop, the more deeply situated limb of which is attached to the posterior surface of the coccyx (*segment coccygien direct*), and the other more superficial limb extends obliquely from a caudal and ventral position to one more dorsal and cranial (*segment coccygien réfléchi*). During the course of the fourth month the more deeply situated limb atrophies and disappears, while the more

superficial one, the *segment coccygien réfléchi*, continues to develop into the fifth month and gives origin to cell cords or cell masses which contain cavities lined either with prismatic or pavement epithelium; these are the *vestiges medullaires coccygiens* or *paracoccygiens*. These structures from the sixth month on suffer a progressive atrophy, but it is possible to recognize traces of them up to the time of birth.

The caudal end of the central canal extends through the *conus medullaris* to the beginning of the *filum terminale*. At its lower end it undergoes a

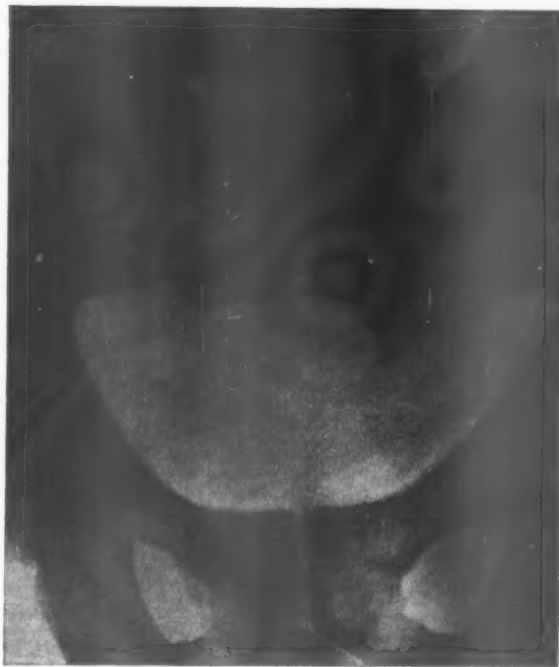


FIGURE IIA. Skiagram taken in antero-posterior direction.

conical expansion, out of which open irregular side pouches and occasionally a blind sac giving the canal the appearance as though it were bent on itself. This caudal enlargement of the canal is known as the *ventriculus terminalis*.

In the earlier stages of development the spinal cord and mesoderm develop at approximately the same rate. Later there is a relative increase in the rate of growth of the vertebral column. From the third month on into adult life the cord lags increasingly behind. As a result of this, and due to fixity at the cephalic end, the caudal end is drawn upwards from the lower end of the canal, and in the adult is opposite the first or second lumbar vertebrae. The caudal tip remains attached to the coccyx and the intermediate part becomes stretched out as the *filum terminale*.

#### Clinical Report.

The patient, a man of fifty, in apparently good health, complained of piles which had bled intermittently for some years. He also mentioned mild sciatic pain from which he had suffered since an attack of acute sciatica a year previously. There was nothing of note in the previous history or family history.

The sciatica commenced suddenly one year previously following exposure to cold and wet. Pain commenced in the right buttock and in twenty-four hours was very acute. It spread to the sole of the foot and the calf of the leg. Shortly after this the left leg became involved, and both legs wasted considerably. Pain was very acute and prevented sleep. He was seen by his doctor on the fifth day, and was under treatment, confined to bed, for one month. Pain and wasting improved, and, apart from slight twinges, he was practically well for nine months. Recently there had been more pain on the right side. Soon after he was



FIGURE IIE: Skiagram taken in lateral position.

sufficiently recovered from his sciatica to get about, he was given an opaque enema and examined with normal findings. He was told that his liver was much enlarged. His tonsils were removed at this time.

His appetite was good, and he suffered no indigestion, provided reasonable care was taken with his diet. There was no abdominal discomfort. His bowels were regular and motions normal, except when he had bleeding from the piles. There was no urinary disturbance or symptoms referable to heart or lungs.

On examination in June, 1933, the patient was a sturdily built, healthy-looking man. In his chest nothing abnormal was found. His abdomen was rather protuberant. The liver was much enlarged, reaching down nearly to the umbilicus. The left lobe enlargement appeared to be relatively greater than the right. The liver was of smooth, even firm, consistency, and was slightly tender. No jaundice was present. There was no free fluid in the abdomen. Rectal examination revealed a normal sphincter. The prostate and vesicles were normal. Internal hæmorrhoids were seen with a speculum.

The region of the coccyx was tender and the normal bony outline of the lower sacrum and coccyx was replaced by a firm, smooth, elastic swelling. It was about 3.75 centimetres (one and one-half inches) in breadth and a little less in the antero-posterior plane. Bimanual examination, with one finger externally over the coccyx and one in the rectum, revealed an apparent replacement of bone by the tumour.

Skiagrams taken in the anterior, posterior and lateral positions are reproduced in Figures IIa and IIb. There is an absence of coccyx and lower part of the sacrum. The similarity radiographically to a case of chordoma recently published in this journal is striking.<sup>(11)</sup>

X ray examination of the liver revealed general enlargement. The chest was not examined radiographically.

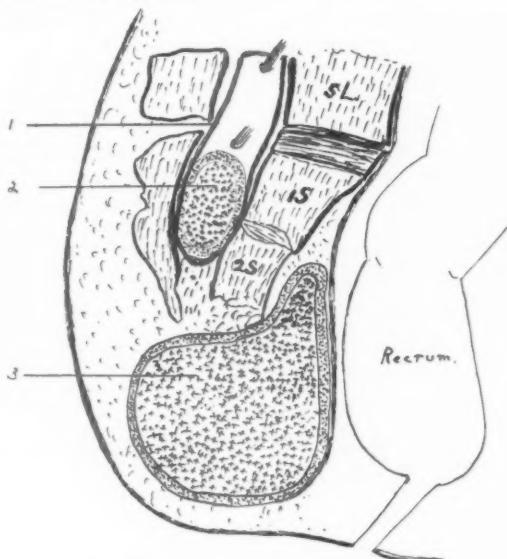


FIGURE III.—Diagram of condition found at operation.  
1 = Dura mater. 2 = Tumour in sacral canal. 3 = Tumour replacing coccyx and part of sacrum.

Sensation and reflexes were all normal. There was no loss of power and no wasting. There was a doubtful slight change in perception behind the anus over an area covering a few square inches. This was found on two occasions, but was not confirmed by other observers. The urinary system was normal. The Casoni test gave no reaction. The complement fixation test in his serum for hydatid disease gave no reaction.

During the two months he was kept under observation he lost weight, became anæmic, and looked decidedly ill. Pain in the legs increased, and this was associated with a feeling of stiffness and aching in the lower part of the back. There was no change in the abdominal condition.

Operation was advised in August, and consent was given for exploration of the anococcygeal tumour, but not for biopsy of the liver. In view of the prolonged liver history, it was thought that the condition of the liver and the tumour of the coccyx were possibly dissociated.

A 15 centimetre (six inch) incision in the mid-line was made from 2.5 centimetres (one inch) behind the anus upwards. The second piece of the sacrum was first exposed and dissection was carried forwards below this until the tumour was exposed. A cavity 5.0 centimetres (two inches) in diameter was entered and found to be filled with a brown friable grumous mass. This cavity extended in front of the sacrum and had other irregular ramifications. The wall had the appearance of skin. There was no plane of cleavage between the tumour and the surrounding tissues (Figure III).

In view of the sciatic distribution of his pain, and the unlikelihood of this cyst being a cause of his symptoms, it was decided to explore the upper part of the sacrum. The bone on the left side appeared eroded, as was the posterior inferior spine of the ilium. A mucinous fluid occupied the eroded areas. The bone was nibbled away until dura appeared.

A firm tumour was felt occupying the lower part of the dural sac. On opening through the dura, it was found to be adherent and the thick wall of the tumour was incised. It contained brownish friable material similar to that found in the coccygeal cyst. Contents and wall were curetted and Zenker's fluid was applied. The resulting cavity was about 2.5 centimetres (one inch) long and 1.8 centimetres (three-quarters of an inch) wide.

Cerebro-spinal fluid leaked from the upper end of the opened dura, and it was then seen that the tumour lay in a central position between the nerve roots. It was not possible to trace any direct connexion between this cyst and the one in the coccygeal region. The dura was sutured with fine silk and the wound was closed. Healing was satisfactory. Convalescence was complicated by acute pleurisy, first on the left side and later on the right, and on the patient's discharge to his home town by ambulance there was a small effusion at the base of the right lung.

A recent report states that he was improved in general health and put on weight, "but his appearance is still suggestive of a man with a carcinoma". He still has dulness at the base of the right lung with crepitations. The liver condition is unchanged.

#### Pathological Report.

I am indebted to Professor D'Ath, of the Otago Medical School, for the following pathological report.

The specimens submitted for microscopic examination consisted of curettings from: (a) the lower sacral tumour, (b) the upper intradural tumour.

(a) *The Lower Sacral Tumour.*—Portions of the wall of this tumour present in the curettings show it to consist of fibrous tissue lined inside by squamous epithelium showing considerable keratinization. Hair follicles and sebaceous and sweat glands were present. Another portion of the wall consisted of closely packed foreign body giant cells lying in a fibrous connective tissue stroma. The contents of the cyst were desquamated keratinized epithelium, shed epithelial cell groups, and sebaceous material in which were numerous hairs. It is a congenital sacrococcygeal cyst.

(b) *The Upper Intradural Tumour.*—Curettings from this tumour showed it to be of entirely different origin from the lower one just described. It was composed of columnar cells similar to, but larger than, those of the normal ependyma. Portions of the tumour presented these cells in a solid arrangement with very little acinar formation. Adjacent areas showed a definite perivascular arrangement with the cell base towards the blood vessel. Portions of the tumour showed a papillary arrangement, the papillary core being composed of a vascular and mucoid stroma lined by a single layer of columnar cells. In other parts a definite acinar arrangement of the cells was seen, the acini containing a mucoid material. The blood vessels were thin walled and abundant. Portions of the tumour had undergone necrosis.

Owing to the curettings having been received at the laboratory in methylated spirit, it was not possible to pursue further the microscopical appearance of this tumour by special staining methods.

The appearance, however, would suggest that the tumour was an ependymoma of mixed type arising from the intradural *filum terminale* or *conus medullaris*.

#### Summary.

This case presents the interesting feature of two tumours of entirely different histological structure apparently derived from portions of the same developmental remnant. From the brief description of the origin of the *vestigis coccygiens* it will be apparent that the difference in histology in the two tumours is in keeping with the developmental origin of the portion of this vestigial structure from which they are derived.

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## INTRACRANIAL PNEUMATOCELE (PNEUMO- CEPHALUS) ASSOCIATED WITH AN ORBITO-ETHMOIDAL OSTEOMA.

By F. GORDON BELL,  
*Dunedin.*

IN May, 1927, Harvey Cushing<sup>(1)</sup> gave a presidential address before the American Surgical Association on "Experiences with Orbito-Ethmoidal Osteomata Having Intracranial Complications". In the course of his address, fascinating alike in its simplicity and candour and in its wise commentary on the overlapping of the fields of the general and specialist surgeon, he remarks in his discussion of Case III: "But the cranial X ray films disclosed an amazing and unfamiliar picture." His initial summary of this case which excited his amazement runs as follows:

Huge intracranial pneumatocele of unexplained origin exposed and emptied at operation. Recurrence of pneumatocele. Second operation, revealing a minute pneumatic sinus alongside an orbito-ethmoidal osteoma. Closure by fascial stamp. Recovery.

I wish to record the following case which offers an almost exact parallel and which provided me with a possibly similar thrill when I viewed the X ray films.

### Case History.

K.H., aged twenty-eight years, a healthy well-built young man, employed in a wool and grain store, was admitted to Dunedin Hospital on July 5, 1933, for left-sided spastic hemiplegia.

About seven years previously he had sustained an injury at football to his frontal region and had evidently been mildly concussed. He was in no way incapacitated and carried on his work for about a year, when suddenly his left foot and leg became useless and, later on, his left arm. Rest and three months' sojourn in hospital effected little improvement. At about this time sudden blurring of vision occurred and headache developed, the pains being situated behind the right eye in the frontal region.

He ultimately returned to his work, and for the past six years has carried on, though at all times there has been weakness of the left leg and arm, and his disability has been subject to exacerbations.

During the last four years, convulsions, apparently of Jacksonian type, have occurred from time to time on the affected side.

On admission to hospital he was conscious and alert, but displayed a left facial paresis and obvious left-sided spastic paralysis. The neurological picture was as follows. There was weakness of the left lower seventh nerve. The pupils were equal and reacted to light and accommodation. The result of the examination of the reflexes and so forth is shown in Table I.

Two days after admission to hospital he complained of intense headache. Lumbar puncture was performed and the laboratory reported the cerebro-spinal fluid as normal. Next day he appeared better, but that evening rapidly became worse, with severe headache and increasing drowsiness.

At this stage I was asked to see him, and in the meantime X ray examination had revealed the truly amazing picture shown in Figures 1A and 1B. Dr. Barclay, the radiologist, reported:

There is an osteoma arising from the orbital plate of the right frontal bone close to the mid-line and apparently encroaching on the frontal sinus. There is an extensive right pneumocephalus with displacement of the falx and compression of the brain substance. The air probably lies in the subdural space.

In view of the radiographic evidence of pressure and the alarming increase in the severity of the symptoms it was decided to operate forthwith.

*Operation.*—Under local "Novocain" analgesia and with the assistance of my colleague, Mr. Renfrew White, a right frontal osteoplastic flap was turned down, revealing a very tense dura and a markedly tympanitic frontal lobe. This was punctured, air escaped, and the dura and brain became collapsed and flabby. It was now possible to strip the dura towards the base of the skull, following the orbital plate till the osteoma was reached. I now found that a projecting spiked nodule had perforated the dura so that the osteoma was partly extradural and

TABLE I.

Observation.	Right.	Left.
Biceps jerk .. .. .	+	++
Triceps jerk .. .. .	+	++
Supinator jerk .. .. .	+	++
Knee jerk .. .. .	+	++
Ankle jerk .. .. .	+	++
Plantar reflex .. .. .	Flexor	Extensor
Abdominal reflex .. .. .	+	—
Clonus .. .. .	—	+
Tone .. .. .	Normal	Rigid (spastic)
Coordination .. .. .	+	+
Power, Arm .. .. .	+	General weakness
Power, Leg .. .. .	+	General weakness, foot-drop, and 2.5 centimetres (one inch) of wasting of thigh and calf muscles
Sensation .. .. .	Normal	Normal

partly intradural, and the dura required to be incised and freed to display it completely. It was about 2.5 centimetres (one inch) long in the sagittal axis and rather more than 1.25 centimetres (half an inch) in width and thickness, with sharply spiculated tuberculations. It was transversed at its attachment to the floor of the skull by a small foramen ("the minute pneumatic sinus" of Cushing), which clearly transmitted air at each inspiration from the ethmoidal cells below to the subdural space above by way of the breach in the dura referred to previously.

The osteoma was chiselled off the orbito-ethmoidal junction, but, being brittle, fragmented to the detriment of the specimen.

I was now faced with the problem of preventing further access of air. Though the brain was still tympanitic, I argued that if more air were prevented from getting into it, that present would absorb, and, as it turned out, this argument was correct, though the method of prevention is open to criticism. Before operation I had taken the precaution of looking over Cushing's article on the olfactory groove meningiomata, but had completely overlooked the address referred to at the beginning of this report, which would have signposted the way for me. Instead of interposing a fascial barrier as he recommended, I placed a sheet of rubber dam against the exposed brain surface, which could not be covered with accurately sutured dura, and packed the raw surface of bone with iodoform gauze, the dam and gauze being brought out through the inner angle of the

wound and left in place for a week. I am consoled, however, by Cushing's confession that he did not think, in his first case, of utilizing a layer of fascia as a barrier to sepsis and ingress of air.

*Result.*—By good fortune, the patient made an excellent recovery, marred only by a transient spasm of the left arm occurring three weeks after operation on two successive days. Power in the left arm and leg rapidly improved, and the extensor response disappeared, though the knee and ankle jerks remained very active.

The residual air in the pneumatocele steadily diminished, and its progress may be traced in Figures II*A* and II*B* and III*A* and III*B*.

Five weeks after operation a trifling amount of air remained, and the patient was discharged in excellent condition, though still with a slight spasticity in the left leg.



FIGURE 1A. Antero-posterior skiagram of skull on the patient's admission to hospital, July 6, 1933, showing large intracranial pneumatocele associated with an orbito-ethmoidal osteoma.

FIGURE 1B. Lateral skiagram of skull on the patient's admission to hospital, July 6, 1933, showing large intracranial pneumatocele associated with an orbito-ethmoidal osteoma.

Seen six months after operation he is well, expresses himself as freed from all symptoms, and radiography shows a complete disappearance of the pneumatocele.<sup>1</sup>

#### Comment.

Cushing states in his address that so far as he knows the combination of pneumatocele with osteoma is previously unrecorded. He discusses the possible relationship of the osteoma to injury and suggests that a crack or diastasis at the orbito-ethmoidal suture may stir quiescent cartilage cells into activity. In the present case, the injury at football some seven years previously possibly provided such stimulus and, considering the delicacy of bone structure in this neighbourhood, it would seem likely that minor fissures might occur not infrequently as a hidden part of the picture of concussion.

<sup>1</sup> Since the above was written this man has had an epileptiform seizure coinciding with a period of heavy work during the recent wool season. X ray examination, however, discloses no reaccumulation of air.



FIGURE IIA. Antero-posterior skiagram of skull after operation on August 8, 1933, showing considerable diminution of residual air.

FIGURE IIB. Lateral skiagram of skull after operation on August 8, 1933, showing considerable diminution of the residual air.

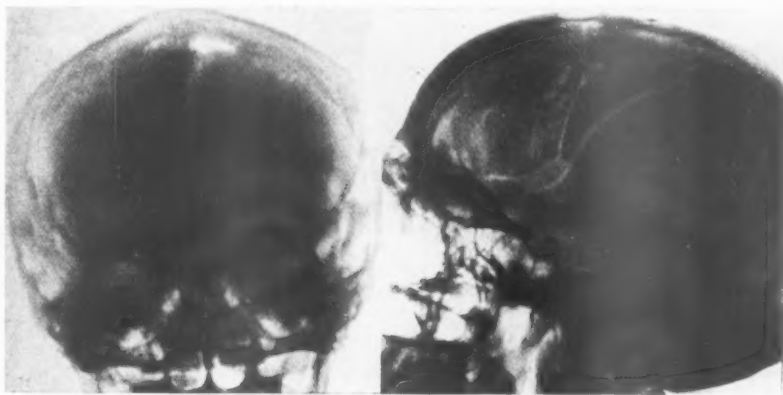


FIGURE IIIA. Antero-posterior skiagram taken on September 7, 1933, showing almost complete absorption of the remains of the pneumatocele.

FIGURE IIIB. Lateral skiagram taken on September 7, 1933, showing almost complete absorption of the remains of the pneumatocele.

Cushing further refers to an article by Dandy<sup>(1)</sup> dealing with 25 cases of intracranial collections of air as a consequence of fractures passing through the paranasal air sinuses, but not associated with osteomata. In one of Dandy's cases the pneumatocele had finally opened into the lateral ventricles.

As regards the mechanism of pneumatocele formation in the present instance, there seems little doubt that the small foramen alongside the attachment of the osteoma provided access of air to the subdural space. Having gained entry, the air would increase in amount and the question arises as to why it did not diffuse over the whole hemisphere instead of remaining localized. No definite smooth-walled sac was demonstrated in this case, but it was found on raising the dura off the outer surface of the frontal lobe posteriorly that there were firm adhesions between dura and pia-arachnoid which provided a barrier to the backward extension of air. Such adhesions might be due to a surface film of blood dating back to the initial concussion injury, and possibly the accession of mildly infected air subsequently might excite the formation of limiting adhesions.

It would seem necessary to postulate either a valvular mechanism or else some periodic variation in the tension of the pneumatocele to account for the exacerbations noted in the history and also for the Jacksonian attacks. According to the man's statement, sneezing or nose-blowing did not aggravate the symptoms. That air is capable of absorption from a pneumatocele is proved by the rapid disappearance of the residual air after operation in this case, and variable tension due to differences between air accumulation and absorption would account for occasional alteration in symptoms.

#### References.

<sup>(1)</sup> Harvey Cushing: "Experiences with Orbito-Ethmoidal Osteomata having Intracranial Complications", *Surgery, Gynecology and Obstetrics*, Volume xliv, June, 1927, page 721.

<sup>(2)</sup> W. E. Dandy (quoted by Cushing): "Pneumocephalus (Intracranial Pneumatocele or Aerocele)", *Archives of Surgery*, 1926, Volume xii, pages 949-982.

## A CHONDROMA OF THE LARYNX.

By RAYMOND HENNESSY,  
*Melbourne.*

THE patient, a married woman, aged sixty-two years, was seen for the first time in November, 1932.

### Clinical History.

The patient had noticed some difficulty with the breathing for at least seven or eight years and perhaps longer. It was, however, only slight and caused very little inconvenience. It had become more apparent during recent years and was rather noticeable after exertion. Her daughter says that for years the breathing has been noisy during sleep. There was some cough, but no expectoration.

She had never sought medical advice about the breathing until about one month ago. She then consulted a doctor because she had a severe smothering attack. Quite suddenly one day she found herself gasping for breath, she became blue and her distress caused grave anxiety to her family. It was a definite attack of breathlessness, that is, it began and ended suddenly and lasted only for a few minutes.

The doctor whom she consulted diagnosed the condition as inoperable cancer of the larynx and no treatment was advised.

The patient returned to her home many miles away, but soon afterwards had a second and more severe attack of breathlessness. She therefore made a journey of over three hundred miles to Melbourne for another opinion. Apart from this complaint the patient said she was quite healthy.

When she presented herself for examination no dyspnoea was evident, and the voice was only slightly affected. It was observed that the breathing was rather noisy after exertion. Examination with the laryngeal mirror showed a large, round, lobulated, bluish, translucent mass wholly beyond the true cords, which moved naturally and freely. The mass appeared almost to fill the larynx and upper part of the trachea. Small yellowish opaque spots of calcification were plainly visible in the tumour, completing the characteristic appearance of a chondroma.

The healthy and passive appearance of the larynx apart from the tumour was very striking—there was no congestion nor secretion nor other signs of reaction. The tumour appeared to be growing from the posterior segment of the cricoid cartilage. X ray photographs of the larynx and trachea confirmed the clinical diagnosis of chondroma.

At operation a fairly low tracheotomy was performed under local analgesia. During the operation the tumour was sounded with a light probe from below through the tracheotomy wound. It was felt to have the physical characteristics of a chondroma.

The patient was last seen in March, 1934, sixteen months after operation, and is perfectly well. She has only slight impairment of the voice. The dyspnoea has been relieved, and there have been no more smothering attacks. The tracheotomy tube causes no inconvenience and she attends to it herself. On examination with the laryngeal mirror the tumour does not appear to have altered.

**Comment.**

The appearance of the tumour was absolutely typical of a chondroma and the clinical diagnosis was easy. The duration of the history of the dyspnoea and the "quiet" appearance of the larynx show that the tumour had been there for



Skiagram taken in March, 1934. The tracheotomy tube has been temporarily removed.

many years, probably much longer than the symptoms indicate. It is obvious that surgical removal of the tumour was not advisable.

This is a very rare laryngeal lesion.

**Acknowledgements.**

I am much indebted to Dr. John O'Sullivan for excellent X ray negatives and to Dr. Julian Smith, F.R.P.S., for the skilful photographic reproduction from the negative.

## The Australian and New Zealand Journal of Surgery.

All articles submitted for publication in this journal must be typewritten and double or treble spacing should be used. Each article should conclude with a brief summary and statement of conclusions. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without any abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal together with that of the journal in which the abstract has appeared, should be given, with full date in each instance.

When illustrations are required, good photographic prints, on glossy gaslight paper should be submitted. Line drawings, charts, graphs and so forth should be drawn on thick white paper in India ink. Authors who are not accustomed to prepare drawings of this kind, are invited to seek the advice of the Editor if they are in any doubt as to the correct procedure. Skiagrams can be reproduced satisfactorily only if good prints or negatives are available.

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### THE SYSTEM OF ADMISSION TO FELLOWSHIP OF THE COLLEGE.

THE seventh anniversary of the foundation of the Royal Australasian College of Surgeons was notable because it marked the inception of a revised system of admission to its Fellowship. The Founders of the College, in 1927, drafted regulations which were thought to combine the advantages of the senior surgical degree or diploma system, in use throughout the British Empire, with those of the system introduced by the American College of Surgeons. Their motive was to insure that all future Fellows of the Royal Australasian College of Surgeons should not only have had a sound training in the basic principles of surgery, but also should be able to perform operations competently. The chief requirements were a minimum of five years' post-graduate training in surgery and the possession of a senior surgical degree or diploma, though the latter was not made obligatory until after the expiration of a five-year period from the foundation of the College, *id est*, until

February, 1932. A candidate who had fulfilled these requirements applied for admission as a Fellow, giving the names of medical practitioners as references, and, usually, supplying case histories in support of his application. This was then considered by the Credentials Committee of the State or Dominion in which he resided, and this Committee sent a report to the Council, which made the final decision on the application.

Six years' experience of this method of testing the suitability of candidates for Fellowship convinced the Council that, though it was useful during the period of the foundation of the College, it was unsatisfactory as a permanent system and that, therefore, a radical alteration was imperative. Fortunately, a six-year-old College is unfettered by tradition, so that it was not difficult to bring about the desired reform. There was never any intention of abandoning the fundamental principle of superimposing upon a sound training in the basic principles of surgery, entailed in the acquisition of a senior surgical degree or diploma, a period of apprenticeship to a senior surgeon in operative and clinical work. All that was required was some means of insuring that each candidate had been properly trained and had profited adequately from his training. To gain these ends, it was decided that the duty of determining whether a candidate had undergone a satisfactory period of training should devolve upon the Censor-in-Chief of the College, and that each candidate, whose training had been approved by him, should appear in person before a Board of Censors of the College empowered to submit him to such tests of his knowledge and ability as seemed desirable in each individual case. For geographical reasons, it was decided to appoint one Board of Censors in Australia and another in New Zealand, but the Censor-in-Chief, when present, acts as Chairman of each Board. The other members of the Australian Board of Censors are Professor H. R. Dew, L. C. E. Lindon, Sir John McKelvey, Balcombe Quick, R. B. Wade, B. T. Zwar, and of the New Zealand Board of Censors, Sir Hugh Acland, Sir Louis Barnett, Professor F. Gordon Bell, Sir Donald McGavin, Sir Carrick Robertson, D. S. Wylie.

In actual practice, uniformity of training is not demanded by the Censor-in-Chief. Credit is given for the time spent as a resident medical officer, in work in university departments and in other countries, and in research, but emphasis is laid upon the desirability of an apprenticeship period to a senior surgeon. The practice of attempting to qualify by performing a series of operations unaided and unsupervised is viewed with disapproval.

Candidates whose applications to appear before a Board of Censors are refused by the Censor-in-Chief, are informed of the additional training demanded and, if dissatisfied with his decision, are entitled to appeal against it to the Council of the College.

Full information concerning the candidates granted permission to appear before a Board of Censors is circulated to all members of the appropriate Board. Reports are obtained from surgeons with whom the candidate has worked, his contributions to surgical literature, if any, are studied, and all details of his training are verified. In short, before his interview with the Board, an endeavour is made to determine what manner of man he is. Then follows his appearance before the Board, which, at present, consists of a talk with the candidate extending over a space of twenty minutes upon practical problems in surgery. The expression "at present" is used advisedly, because the Board has the power to vary the test in the light of its experience. It has found, however, that it is possible to conduct a very searching inquiry during the twenty minutes as to how far a candidate has profited by his training. The decision of the Board does not depend exclusively upon the answers given by the candidate in this space of time, for it also gives credit for the work he has done during the training period. Adequate time is allowed after each interview for a consultation among members of the Board upon the merits and demerits of each candidate, based partly upon their personal observation of him and partly upon the reports received concerning the work he has done.

When the College was founded, it was decided to include gynaecologists, ophthalmologists and laryngo-otologists among its Fellows, and it was therefore necessary to draft regulations for admission in these specialties in addition to those, just described, governing admission in surgery. Candidates who propose to practise gynaecology are expected to undergo an adequate training in general surgery, so that it was unnecessary to create a Fellowship in gynaecology with separate tests of the suitability of these candidates. The College grants Fellowship in ophthalmology and also in laryngo-otology, and has applied the same principles of a senior degree or diploma and a five-year apprenticeship period to these specialties. The Censor-in-Chief appoints Fellows who have specialized in the appropriate subject to assist the Board of Censors in its interviews with these candidates. These assessors question the candidate and advise the Board concerning his qualifications, but the final decision is made by the members of the Board alone, who are expected to satisfy themselves that each candidate possesses some

acquaintance with the general principles of surgery in addition to an adequate knowledge of his specialty.

Candidates rejected by the Board must undergo a further period of training before permission is granted to reappear before it. The Board may defer a candidate, who then may reappear before it at a subsequent meeting without making another application to the Censor-in-Chief. Candidates approved by the Board then apply to the Council for election as Fellows, and must sign a pledge of obedience to the rules of the College. It is the duty of the Council to determine the suitability of each candidate from the ethical point of view.

It is not thought that this system is perfect—"perfection is finality and finality is death"—but it seems probable that, though amendments may be necessary from time to time, the general principles underlying this method of testing the qualification of candidates for Fellowship will remain the policy of this College.

ALAN NEWTON.



## Surgery in Other Countries.

[In this column will be published short résumés of articles likely to be of practical value from Journals published in other countries and not readily accessible to surgeons in Australia and New Zealand.]

### OBSERVATIONS ON THE PHYSIOLOGY AND PATHOLOGY OF RESPIRATION IN RELATION TO SURGERY.

Z. Takács, Nagykanizsa, *Der Chirurg*, January 1, 1934.

TAKÁCS discusses the anatomy and physiology of normal respiration. He draws special attention to the importance of the carbon dioxide-oxygen balance in maintaining the central control of respiration. He then considers the problem of the occurrence of death after sudden wide opening of one side of the thorax. In experiments on dogs, the opening was followed by a short cessation of breathing; this was followed by strong spasmodic efforts, which ceased; the breathing became slower and death resulted.

Takács rejects, as causes of this series of events, such phenomena as the dislocation of the lung and the loss of the lung space, since the body can manage quite well with less than one lung. Pressure on the heart and large vessels cannot explain it, as this occurs without endangering life in the presence of large collections of fluid. Displacement of the mediastinum with pressure hindrance of the other lung is also cited as a cause, but not accepted.

The author has operated on dogs, fixing half the lung against the chest wall on the side to be opened, by suitably placed sutures. On the chest then being widely opened, breathing went on unhindered. Twenty to thirty minutes later the sutures were removed, and the lung was allowed to collapse; and the breathing, apart from being a little deeper, was not affected.

From these experiments, Takács draws the conclusion that an animal is able, given a certain space of time, to surmount the dangerous conditions following wide opening, and he considers that this conclusion is supported by the absence of symptoms following the opening of a chest over an already compressed lung, as in fluid collections and pneumothorax.

His explanation is that the suddenly collapsing lung upsetting the carbon dioxide-oxygen exchange, causes an interruption of respiration, and on account of the upset gas balance the respiratory centre is not able to respond promptly. A certain reflex nervous mechanism also comes into account, but Takács regards the alteration of the carbon dioxide balance as the main factor. After a little time, the opposite lung takes up a compensatory action, and the carbon dioxide concentration in the blood is restored.

ARTHUR BROWN.

### SUBOCCIPITAL DRAINAGE.

Ch. Lenormant and Jean Patel, *Journal de Chirurgie*, July, 1933, Volume xlii, Number 1.

THE authors state that decompression in the occipito-atlantoid region was applied by Ody, in 1930, to traumatic lesions of the brain. This "posterior trephine", which aims at draining directly the great junction of the subarachnoid spaces, the *cisterna magna*, invests the therapeutic problem of the cerebro-meningeal lesions of traumatic origin with a new point of view.

The reasons why this cistern is considered so important are: (i) Its dimensions: it is the largest of all the spaces. (ii) Its anatomical situation: it lies under and in front of the cerebellum, and on and behind the bulb, and slopes from the other systems. (iii) Its connexions: it is the place where the ventricular fluid is poured out across the orifices of Magendie and de Luschka; it is towards this point that the three secondary systems—spinal, basal and sagittal—converge.

The authors group in two categories the arguments in favour of this method of drainage in traumatic cranial lesions:

Firstly, whatever is the initial situation of the hæmorrhage contemporary with the cerebral contusion, the blood exhibits a natural tendency to spread into the cisterns at the base, and, above all, into the great junction of these spaces, which occurs in the suboccipital region, and which is the biggest and most

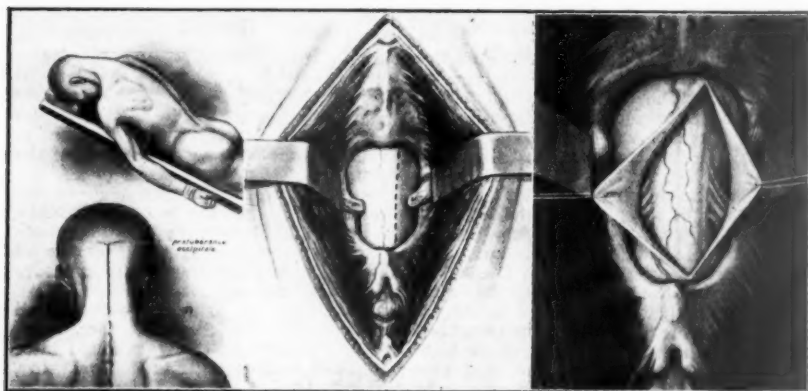


FIGURE I.

FIGURE II.

FIGURE III.

dependent. The clots accumulate at the base of the posterior fossa, and in the neighbourhood of the occipital foramen find the normal narrowing which isolates the cerebral from the spinal cavity. In this situation the blood will have a direct effect on the vital centres of the medulla, and an indirect effect on the resorption of the cerebro-spinal fluid.

Secondly, the blood which accumulates at the level of the great cistern, by the "barrage" that it brings about, disturbs the balance normally existing between the ventricular secretion and the subarachnoid absorption of the cerebro-spinal fluid. A dilatation of the cerebral cavities follows—a hydrocephalus, comparable to that which Dandy (1919) and more recently René Bizé (1931) have been able to bring about in the dog.

The technique of Ody's suboccipital drainage is simple, requires no special instruments, respects the integrity of the cranial box, causes no shock and can be performed in from twenty minutes to half an hour.

The steps of the operation are as follows:

1. The patient is placed in the ventral decubitus, with the head high, on a table which is inclined at a convenient angle; the shoulders are lifted up by a thick cushion in order to obtain hyperflexion of the cervical spine, and thus to diminish the distance separating the atlas from the superficial plane (Figure I).
2. The incision is made from the occipital protuberance to the spine of the fourth cervical vertebra (Figure I).

3. The superficial aponeurosis is separated from the transverse processes by means of a special rugine (Ody). The muscular masses are separated from the nape of the neck, and hæmostasis is obtained by tamponade.

4. The posterior arch of the atlas is laid bare, and resected, for about two centimetres, by means of a bone forceps (Figure II).

5. The occipito-atlantoid membrane now appears at the depth of the wound. In order to avoid the dural vein, a paramedian incision is made in this membrane (Figure III). Through this opening, clots and blood stained cerebro-spinal fluid, as a rule, issue in considerable quantity and under considerable pressure. The rather sudden decompression which occurs does not seem to injure the patient. Sometimes, pressed out by the hypertension, a tonsil of cerebellum becomes incarcerated in the vertebral opening. This is, however, easily reducible. Occasionally, in order to facilitate the flow of cerebro-spinal fluid, it may be necessary to resect the edges of the incision in the occipito-atlantoid membrane. Drainage by means of a wick or a glass tube is provided. As a rule, the dressings are at once soaked with cerebro-spinal fluid. At the end of four or five days the flow of spinal fluid diminishes and becomes clear; the drain is now superfluous, and it is taken out. The fistula soon closes.

*Application.*—It is doubtful whether this method of decompression is of any value in ameliorating the immediate prognosis, or diminishing the mortality, when applied, in the first twenty-four hours, in the treatment of cases which, for want of a better name, are designated under the name of "*commotio cerebri gravis*".

It should be used when one is able to confirm by a ventricular puncture that an internal bilateral hydrocephalus is present. If ventricular puncture drainage is not sufficient, the question of suboccipital drainage should be considered.

Recourse to the posterior trephine should be had when the state of the injured person, notwithstanding all therapeutic attempts, becomes obviously worse, and when there is a blockage in the vicinity of the bulb.

The statistics which Ody has published are meagre, but they are uniformly good. Among eight cases there was one death. Other series are not so happy (Oltremare: 2 cases, 2 deaths; J. Patel: 1 case, 1 death). Patel emphasizes the fact that this intervention combats efficaciously any manifestations of hypertension; it is not applicable when the disorders are profound.

H. B. DEVINE.

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THE SURGICAL EXCISION OF PELVIC GLANDS SUPPLEMENTING RADIOTHERAPY OF  
CARCINOMA OF THE CERVIX UTERI.

Lacques Leveuf and Henri Godard, *Journal de Chirurgie*, February, 1934,  
page 177.

LEVEUF and Godard have been concerned with the effect of radiation upon carcinoma of the cervix. Although the primary lesion can be adequately dealt with, the deeper spread, especially to the pelvic glands, is not satisfactorily treated by our present radiotherapeutic methods. They emphasize the fact that glandular involvement occurs early and regularly in the proliferating type of *carcinoma cervicis*. They suggest that in cases of this type the affected glands should be excised six to eight weeks after the primary lesion has been treated by radiotherapeutic methods.

In an interesting anatomical investigation, they have proved that the main afferent lymphatic channels are grouped round the uterine artery and terminate in a large gland which lies well forward in the pelvic cavity below the external iliac vein and usually in contact with the obturator nerve (Figures I and II). They state that it is uncommon for the afferent lymphatic channels to pass directly to the gland at the iliac bifurcation, as is suggested by classical authorities.

An operation is described which is less severe than the classical Wertheim operation, and allows complete removal of the gland-bearing tissue in the parametrium.

A short series of personal cases are included. There was 15% operative mortality. Of patients with the fungating type of *carcinoma cervicis*, in which histologically involved glands were removed, 70% were well at the end of five years.

**Technique of Operation.**—The operation consists of the removal in one piece of the main lymphatic glands and the principal efferent lymphatics which terminate in them. The plane of tissue can be easily separated. The principal landmark is the uterine artery itself, around which are grouped the lymphatic channels; these are never situated deeper in the pelvis. All deep dissection in the lateral vaginal areas is not only quite useless, but also dangerous, because veins may be injured here and hæmostasis is sometimes difficult.

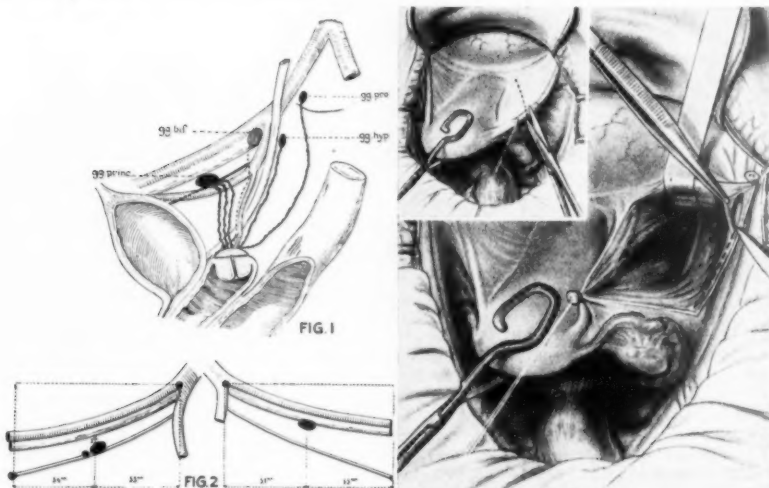


FIGURE III.

The first stage consists in division of the round ligament, opening the right broad ligament and dissection of the external iliac vein (Figure III). The round ligament should be divided between two ligatures and the top of the anterior leaf of the broad ligament should be divided before the surgeon proceeds to its deeper part, where the two peritoneal flaps can be retracted. Whilst this dissection is performed, care must be taken not to injure the ovarian artery and the anastomosis with the uterine artery, as this is the only blood supply to the uterus after the two uterine arteries are ligated. Laterally, the large external iliac vein can be seen where the freeing of the outer edge of the lympho-glandular plane is commenced by dissection with the scalpel. The incision at the outer edge of the tissue plane upon the external iliac vein is the delicate procedure at this stage.

The second stage consists in liberation of the tissue plane at deeper levels. By careful dissection, the tissue plane is freed steadily, being held by two Pean's forceps. In this fashion the iliac vein is left, and the operator soon comes down to the obturator nerve, which is usually in contact with the glands and which

makes an excellent landmark. In front, the dissection is limited by the ridge of the obliterated umbilical artery, which is divided between ligatures. Posteriorly, the main anterior division of the hypogastric artery is freed and divided above the origin of the uterine artery.

The third stage consists in liberation of the ureter. As the tissue plane is dissected up in following the uterine artery, the ureter is demonstrated without any difficulty. However, this dissection should be conducted with caution. When the neighbourhood of the bladder is reached in front, the stump of the uterine artery is ligatured and the vesical branches of the umbilical artery are also tied, if seen. The dotted line shows the line of division of tissue.

In the fourth stage, division of the lympho-glandular tissue plane is carried out. The lymphatic tissue plane is now removed. It is cut across in front close to the bladder. This procedure is often a delicate one, for in this area there is often considerable perivesical fat which makes definition of the bladder difficult. Then the small inner base of the tissue plane is sectioned nearly level with the uterine isthmus, the operator remembering that the ureter is in close proximity at this point. To be quite sure of avoiding the ureter, a small copper retractor may be slipped behind the tissue plane. Hemostasis is secured, and the broad ligament is closed by catgut suture. The same procedure is carried out upon the opposite side. The abdomen is then closed without drainage.

J. BUCHANAN.

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COD LIVER OIL AND PLASTER BANDAGE TREATMENT OF WOUNDS OF THE HAND AND FOOT WITH LOSS OF SUBSTANCE.

Professor W. Löhr, Magdeburg Anstalt, *Der Chirurg*, Volume VI, 1934, page 5.

The author endeavours to set out a simple form of treatment by cod liver oil for lacerated wounds of the hands and feet. Cod liver oil as commercially used is sterile, and has even an inhibiting effect on the growth of staphylococci and streptococci. It can be used without any sterilization, and thus retains its vitamin content intact.

Without going deeply into causes, Löhr affirms that cod liver oil has an excellent stimulating effect on the mesenchymal tissues, and also greatly stimulates the ingrowth of epithelium. He is very much opposed to the use of foreign materials such as drain tubes and gauze strips, and avoids the use of chemical disinfectants as much as possible. He also considers frequent change of dressing to be definitely harmful to healing wounds. The early closure, after cleansing, of hand and foot injuries results, as he points out, in a very high percentage of clean healing, even when the wounds are mildly infected; in contrast to the painful and disabling scars left after healing of open and infected wounds.

His treatment is, briefly, to cleanse the wound of dirt and damaged fat tags; to smear it thickly with a mixture of cod liver oil and vaseline; and then to enclose the whole injured part in a plaster bandage, which then remains unchanged for two or three weeks. The exact composition of the vaseline and oil mixture is not set out in the article.

Under the plaster the wound heals by granulation and epithelial spread, protected from secondary infection. When the wound has been seen early and is fairly clean, there is very little discharge. When it has been definitely infected there is a fairly profuse discharge, but this is unimportant. On the first changing of the plaster it is usual to see the digit taking something of its normal shape, with much granulation tissue and active ingrowth of epithelium.

In some hundreds of cases Löhr has seldom seen signs of skin irritation under the plaster. He has never yet had to remove a plaster put on in a reasonably clean case. Pain, swelling, fever *et cetera*, would be indications for removing it. He states that smell from the dressing is not a trouble in clean

wounds, but in infected wounds it sometimes renders removal of the plaster advisable. Photographs of eight cases certainly afford impressive support for his argument in favour of the treatment.

ARTHUR E. BROWN.

THE TREATMENT OF SURFACE BURNS WITH COD LIVER OIL SALVE.

Professor W. Löhr, Magdeburg, Anstalt, *Der Chirurg*, January 1, 1934.

In a further article in *Der Chirurg*, Löhr recommends his cod liver oil treatment for surface burns of the first, second and third degrees. Whilst paying a tribute to the value of tannic acid, he considers that it must be supplanted by his treatment in burns of the face, genitals and perineum, where the technical difficulty of obtaining good crusting is evident; in the treatment of those patients who are forced to lie on some portion of the burned area; and in those cases in which the tannic acid crust has been separated off by underlying infection. Löhr himself uses the cod liver oil treatment by preference with or without plaster bandaging in all cases *ab initio*. Its advantages are that: it minimizes shock; it is absolutely painless to apply; it swiftly eliminates what infection there is in the wound; and it brings about extraordinarily swift epithelialization and healing. Death due to delayed toxæmia does not occur, or has not in any case in Löhr's clinic. In the three years since he has been using the method he has not done one skin graft.

The preparation used is one of such consistency that it forms an oily mass in contact with the tissues, which are impregnated with it. Necrotic and semi-necrotic tissues are disintegrated and dissolved by it. The mixture of oil and destroyed tissue doubtless contains many bacteria, but their toxicity is removed. This is evidenced by the fact that when such a suppurating cavity as that of an acute osteomyelitis is filled with the salve and the wound is closed over it, there are no symptoms of resorptive toxicity, but a normal temperature and often primary healing.

Second degree burns, particularly on the extremities, where callous ulcers are likely to form, are usually treated by salve and plaster. Blebs and loose skin are not removed, as all these necrotic shreds are soon dissolved by the cod liver oil. The area burned is covered with a finger's thickness of salve, a thin muslin sheet is wrapped round this, and the whole is covered by a plaster bandage casing. Even in very extensive burns it is extraordinary how swiftly the skin regenerates. The secretion under the plaster is at first very profuse, and the emulsion of oil and pus together often seeps through the plaster. It may even soften the plaster, which then needs changing. Second degree burns usually heal with a single plaster remaining in place for two weeks. If a small patch remains unhealed, it may be treated by a dressing of salve without plaster. The plaster is removed only on account of softening or excessive smell. Maceration or irritation of the skin does not occur, and is never a cause for removal of the plaster. The scars formed under it are always smooth and thin, never keloid. An added advantage in young children is the protection from soiling and secondary infection which it offers.

In third degree burns of great extent, the secretion is so profuse in the first few days that the plaster would be softened and need removal, which is painful; therefore Löhr does not use plaster in the early stages of these burns. The patients are laid on sterile cloths previously covered with a finger-thick layer of salve, and this cloth is wrapped round to cover the whole limb or burned part. Change of dressing is then quite painless, and when the cloth is withdrawn the salve adheres to the granulations, which are thus not disturbed. Anyone can convince himself of the value of this method in young children, in whom the change of dressing is absolutely painless. Later, when the profuse secretion of the early stages has eased down, plaster bandages are applied. The plaster in this stage is particularly useful in the neighbourhood of joints, when one has any reason to fear contractures. Keloid formation is much less marked when plaster bandages are used.

The treatment is effective when commenced at any stage of the treatment of burns. One of Löhr's photographs shows an enormous unhealed burn ulcer in a woman of sixty, three months after treatment by other methods, and its complete healing after two months of the cod liver oil treatment. Löhr uses the method also to avoid skin grafting in a raw area left after extensive radical removal of the breast, and with success.

His total mortality among 120 patients with second and third degree burns admitted to his clinic as in-patients during the last three years, is 8%, the mortality from primary wound shock alone being only 4%.

ARTHUR E. BROWN.

#### A TREATMENT OF FRACTURED JAW.

**Johs. Ipsen**, of the Surgical Department of the State Hospital in Sönderborg (Denmark), *Zentralblatt für Chirurgie*, Number 49, December 9, 1933.

IPSEN, in describing treatment of the fractured jaw, states that the fractured lower jaw is first fixed against the teeth of the upper jaw so that it articulates normally.

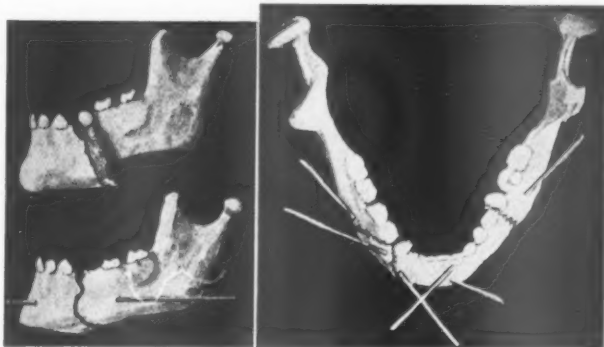


FIGURE I.

FIGURE II.

This position is obtained by calling in the assistance of a dental surgeon. In this position, a Kirschner wire is drilled through the fracture, as shown in Figure I. If there be more than one fracture in the jaw, more than one Kirschner wire may be required. Figure II shows the way in which these are used. After the Kirschner wire has been fixed in place, the patient can be allowed to move the jaw and to open the mouth. This is a considerable help in the after treatment, in which it is necessary to keep the mouth as clean as possible.

H. B. DEVINE.

#### INVESTIGATIONS REGARDING THE FIRMNESS OF THE OSTEO-SYNTHESIS OBTAINED WITH THE AID OF SMITH-PETERSEN'S NAIL CARRIED OUT ON ARTIFICIALLY PRODUCED MESIAL FRACTURES OF THE FEMORAL NECK.

**H. Kotrnetz** (from the Second Surgical Clinic, the University, Vienna; Principal Professor W. Denk), *Zentralblatt für Chirurgie*, Number 47, November 25, 1933.

In the Second Surgical Clinic at the University of Vienna it has been the practice for some months past to treat all medial fractures of the femoral neck—except

in cases in which there was definite contraindication—with the three-flanged nail after the method of Smith-Petersen. Consideration of the after-care of patients so treated has raised the question as to how soon fractures of the femoral neck treated with the Smith-Petersen nail can be submitted to weight-bearing or other influences of pressure.

In his endeavour to find a solution, Kotrnetz has carried out a series of experiments. He recognizes that the varying conditions in the living must affect the application of these results. Nevertheless, he feels justified to draw from them certain conclusions. Ten femora were obtained from the bodies of recently deceased old people (mostly over sixty years of age). The bone was fixed in a vice in a position resembling that occupied in the living body. The femoral neck was fractured medially and the fragments were united by means of a Smith-Petersen nail. A soft sling was then placed over the femoral head, and to this sling were attached weights in gradually increasing amounts. The effect of increasing weight is shown in an accompanying sketch. This shows that practically no alteration occurred in the fragments with an imposition of 25 to 30



kilograms (55 to 66 pounds). With an imposition of 30 to 40 kilograms (66 to 88 pounds) the head commenced to sink and to assume a position characteristic of a *coxa vara*. This alteration in position was found to be due to a cutting through by the nail of the cancellous bony tissue of the distal fragment. Little alteration occurred in the position of the distal portion of the nail lying in the femoral head. With a pressure of 40 kilograms (88 pounds) it was found that as a rule the femoral head sank until its lower edge came to rest against the lower cortical surface of the femoral neck. *Pari passu* with the development of this position there occurs a loosening of the nail. Further addition of weight forces the head of the nail upwards. An increase of weight to 80 kilograms (176 pounds) produces a *coxa vara*, with the nail occupying a horizontal position. A gradual increase to 100 kilograms (220 pounds) causes a definite bending of the nail in the region between the separated fragments, the end of the nail now points downwards, and the femoral head tends to slip away from it.

In order to test the influence of the muscular and capsular structures, a similar series of experiments were carried out with the traction force in the opposite direction and with the femoral head fixed. A third series were conducted to determine the resistance of the imbedded nail to any rotary force. It appeared that a rotary force to 20 to 25 kilograms (44 to 55 pounds) was necessary to loosen the nail.

Allowing for a difference of the conditions obtaining in these experiments from those existing in the living, the writer feels justified to draw the following conclusions:

1. A fractured femoral neck freshly united by a Smith-Petersen nail is not able to bear weight immediately without untoward effects.
2. If weight be imposed upon a recently repaired (by Smith-Petersen's nail) fracture of the femoral neck, then the muscular and capsular supporting structures are unable to prevent the development of a *coxa vara*.
3. The firmness of the fractured femoral neck repaired by the insertion of a Smith-Petersen nail does not remotely approach the firmness of the sound bone.

4. The use of the Smith-Petersen nail (properly introduced) allows the limb to be kept at rest without extension and counter-extension and secures repair and union in good position. The fractured neck is enabled to bear weight only when callus and bony formation have completed the process of repair.

In view of the readiness for the nail to cut through the cancellous tissue of the femoral neck following the application of any force, the author suggests the position portrayed in the accompanying photograph as the best position for the nail.

B. T. ZWAR.

#### BLOODLESS RELEASE OF LOCKED MENISCUS OF THE KNEE JOINT.

E. Seifert (*Chirurgischer Universitätsklinik zu Würzburg*), *Der Chirurg*, June 15, 1933.

SEIFERT points out a simple method of releasing the meniscus in a locked knee, based on the work of Kulka, which he considers is not sufficiently recognized. Kulka placed the patient sitting on a table or bed, with the thigh horizontal and the leg hanging loose over the edge. The relaxation of the muscles and the weight of the leg cause a natural extension of the knee, and this, with easy painless swinging movements of the leg, results, according to him, in release of the meniscus in a few minutes. Seifert has used this method often with success, but also often with failure, and he considers the failure to be due to insufficient consideration being given to the importance of abduction and adduction of the knee, and inward and outward rotation of the leg. These movements play a large part in the production of the injury, and should be more regarded.

He suggests laying the patient on a bed or table as in his illustrations. With only slight abduction of the hip joint the leg hangs straight down, and the necessary dangling movements can be carried out. If simultaneous abduction of the injured knee is needed, the thigh must be outwardly rotated, this having the effect of abducting the knee by the weight of the hanging leg. The necessary degree of outward rotation is achieved in the simplest way by wide abduction of the thigh. In these cases it is only necessary to put the patient further on the bed, so that the whole strongly abducted thigh, from the pelvis to near the knee, lies on it. Should, on the other hand, some degree of adduction be required, one must rotate the thigh inwardly, and this is done by putting a pillow under the buttock of the affected side. This should be enough, for high degrees of adduction are not needed. The aim is to get a widening of the joint space in the desired direction. If simple hanging and dangling are not enough, one tries by slight abduction as described to supplement it. Abduction failing, adduction is tried. Seifert recommends this procedure in all cases. It will not be universally successful, but in favourable cases it gets the results in the shortest and simplest way. It is simple, safe and painless, and seems to be anatomically sound.

ARTHUR E. BROWN.

#### RECTAL ANÆSTHESIA: "AVERTIN".

The Ninth Congress of the International Society of Surgery, Madrid, April 15 to 18, 1932, *Journal de Chirurgie*, Volume XXXIX, June, 1932.

ROBERT MONOD (Paris) thinks that it is dangerous, as a regular practice, to use doses of "Avertin" big enough to obtain total anaesthesia. He believes that it is possible to secure all the advantages of the use of "Avertin" by associating its use with another anaesthetic, such as ether or nitrous oxide gas. The great superiority of "Avertin", in his experience, is in the induction of anaesthesia: of all the known anaesthetics, it induces sleep in the most agreeable fashion; it produces anaesthesia rapidly, and with the almost total elimination of the stage of excitement.

Monod gives "Avertin" by the rectum essentially as a basal anaesthetic. He makes the special point that all the very remarkable qualities of "Avertin" as

an anæsthetic may be obtained by using it in the smaller doses with an "*anesthésie complémentaire*". When "Avertin" is used in this way, the smallest quantity of an inhalation anæsthetic is necessary, and those dangers which are due to a special susceptibility in particular persons are avoided, and the full value of the peculiar properties of "Avertin" is obtained. The dose for full anæsthesia, in his opinion, varies between 0.07 and 0.20 centigramme per kilogram of weight. In Monod's practice, "Avertin" is used as a basal anæsthetic in doses from 0.1 to 0.06 and 0.05 centigramme per kilogram of body weight. He holds that the dosage depends on certain factors: on constitution, on sex, on the age, on the general state, and on the susceptibility of the patient to anæsthesia, stout individuals being specially susceptible to the action of "Avertin". For dosage he consults the following table compiled by Domanig:

Sex.	Age.	General State.	Constitution.	Susceptibility.
Man, $\frac{2}{1}$ Woman, $\frac{2}{1}$	Less than 35, $\frac{2}{1}$ More than 35, $\frac{2}{1}$	Good, $\frac{3}{2}$ Medium, $\frac{2}{1}$ Bad, $\frac{2}{1}$	Strong, $\frac{2}{1}$ Feeble, $\frac{2}{1}$	Non-susceptive, $\frac{2}{1}$ Susceptive, $\frac{2}{1}$

Coefficient total	5	6	7	8	9	10	11
Grammes of "Avertin" per kilogram	0.06	0.065	0.07	0.075	0.08	0.09	0.1

For instance:

If a man	= 2
of 25 years	= 2
of strong constitution	= 2
with a bad general state	= 1
and an aptitude to the anæsthesia	= 1
	—
	8
	—

Coefficient for 8 = 0.075 per kilogram, which is the dose of "Avertin" in this particular case.

The choice of a complementary anæsthetic is important, and depends on the same principles as the choice of an anæsthetic in general; that is, the condition of the patient and the preference of the operator. If ether be used, very little suffices, 10 to 30 grammes of ether very often being all that is necessary. Nitrous oxide gas, he considers, is a particularly favourable complementary anæsthetic, and, as a general rule, he thinks this combination provides the "ideal anæsthesia".

He points out that practice has shown that "Avertin" as a basal narcotic may be used with local anæsthesia, although for a time its use was deprecated by many surgeons. Excellent results have been obtained by the use of this combination of anæsthetics in neuro-surgery. "Avertin" should not be used as a basal narcotic in combination with spinal anæsthesia.

H. B. DEVINE.

#### CONTINUOUS DRAINAGE OF THE STOMACH AND UPPER BOWEL IN ILEUS.

C. Hempel, Marburg, *Der Chirurg*, January 1, 1934.

HEMPEL draws attention to the existent danger of aspiration of stomach contents into the lungs during operations on acute intestinal obstruction. After discussing various suggested methods for dealing with it, he proposes continuous drainage before, during and after the operation by means of a tube passed through the nostril into the stomach or duodenum.

The tube he uses is 150 centimetres in length, 26 Charrière gauge; and instead of one or two lateral openings at the lower end, he has twelve, about 1.25 centimetres (half an inch) in size, to avoid blocking by mucosa. The tube is passed into the stomach, which is drained, and a brief wash out is given through it. The tube is then connected to a water suction apparatus. It remains in position throughout the operation and until the next morning, or even for some days. Outflow alongside the tube does not occur, and the anaesthetist is in no way hindered by it. Hempel has not found that the tube causes increased pharyngeal and oesophageal secretion by remaining in position; and no case of aspiration pneumonia has occurred since he has been using it. Patients often volunteer the statement that their distress has been eased by it before the operation; and a lessening of the abdominal distension can sometimes be observed.

During the operation, when the abdomen has been opened, and the obstruction is being sought for, Hempel finds that there is a strong increase in the flow of intestinal fluid through the tube. During the period after the patient comes round from the anaesthetic until the tube is removed, amounts of from 200 to 500 cubic centimetres of foul intestinal contents have been drained off, for the elimination of which the patient would otherwise have had to wait until the re-establishment of peristalsis. In some cases he has been able to pass the tube right through the pylorus into the duodenum and jejunum. Further experiments in the suction of contents from the ileum direct are in progress.

ARTHUR BROWN.

#### THE TECHNIQUE OF PNEUMORADIOGRAPHY OF THE KNEE JOINT AFTER BIRCHER.

J. Oberholzer, Assistant Doctor, Surgical Department of the Kanton Hospital, Aarau, Switzerland (Chief Doctor: Dr. E. Bircher). *Zentralblatt für Chirurgie*, Number 26, page 522, 1932.

The author states that pneumoradiography is a term given to a radiographic method designed as an aid in the diagnosis of internal derangements of the knee joint, and first reported by Bircher in 1929. In this method, positive contrast material, such as "Abrodil" or "Perabrodil", is used with a negative substance such as oxygen or air. The former causes a contrast layer on the synovial membrane, on the meniscus, on the crucial ligaments, and on the cartilage, the surfaces of the joint. The latter, by its negative contrast effect, enables these structures to be very clearly delineated radiographically.

The technique is as follows. The filling of the knee joint is carried out on the X ray table. The oxygen is taken from the ordinary cylinder to which a pressure-reducing arrangement is attached. A specially constructed needle is used for insufflating the oxygen and injecting the "Perabrodil" into the joint. It consists of a short, stout, sharp-pointed needle—the puncture needle—and a smaller, longer, blunt-ended needle with small lateral holes, which fits into it—the insufflation needle. In order to prevent a backflow of oxygen from the joint, this insufflation needle has a tap at its proximal end. The oxygen reservoir is connected to this double cannula by pressure tubing which is interrupted by a small metal box. In the metal box is a renewable cottonwool filter and a metal sieve, and on the box is an airtight cover kept in position by screws. The end of the tube is provided with a pistol grip arrangement, by means of which the oxygen can be allowed to escape slowly through the needle into the joint. A ten centimetre syringe is used for the injection of the "Perabrodil". The puncture of the joint is made under careful asepsis. It is necessary to note that if iodine be used, it must be carefully washed off by alcohol, because it will produce an X ray shadow. The part to be punctured is anaesthetized by means of a local anaesthetic. The needle is introduced laterally to the patella and directed towards the suprapatellar recess in the joint. If a lesion of the medial meniscus be suspected, the puncture should be made laterally; if a lesion of the lateral meniscus, then it should be made medially. Should there be any effusion in the joint, it must be completely aspirated.

When it is certain that the both needles lie in the joint, the positive contrast material is injected. If the needle is not in the joint, but in the peri-articular tissues, injections of the contrast material will infiltrate the tissues and cause irregular contrast shadows. It does not, however, cause any serious injury to the tissues. About two cubic centimetres of "Perabrodil" (the same solution as is used for intravenous injection) are injected into the joint. A little oxygen is now allowed to flow into this joint. The "Perabrodil" solution is then distributed over the structures of the joint by light massage, after which more oxygen is allowed to enter the joint. This is done very gradually, with the hand palpating the joint, so that, as the gas flows in, the joint can be felt to swell under the hand. When the joint is distended with oxygen, the picture is taken. After this, the tap on the insufflation needle is opened, and the oxygen is allowed to escape. Rest in bed after pneumoradiography is unnecessary, and the patient can be allowed to go home.

Seven hundred knees were examined by this method without any untoward effect.

H. B. DEVINE.

## Reviews.

### THE SYMPATHETIC SYSTEM.

**The Surgery of the Sympathetic Nervous System.** By G. E. GASK, F.R.C.S., and J. P. ROSS, M.S., F.R.C.S.; 1934. London: Baillière, Tindall and Cox. Crown 4to., pp. 175, with illustrations. Price: 16s. net.

DURING recent years much interest has been aroused in respect of the sympathetic nervous system, and an extensive literature has grown up around the subject, far too bulky to be studied at first hand by busy practising surgeons. These surgeons will welcome a book such as "Surgery of the Sympathetic Nervous System", by G. E. Gask and J. P. Ross, in which a great deal of valuable matter is presented in a concise and practical way.

In the first chapter the authors deal with the anatomy and physiology of the sympathetic nervous system. The anatomical sketch is on the whole clear and practical, but that part dealing with the innervation of abdominal viscera is marred by the adoption of the anatomical as opposed to the physiological outlook and nomenclature. Thus on page 10 it is stated: "The lower rectum, the bladder and the uterus receive their sympathetic supply by way of the inferior hypogastric (pelvic) plexuses which arise above from three roots." A little later: "The three roots form a plexus . . . the plexus being called the hypogastric plexus, or more commonly the presacral nerve. The presacral nerve . . . divides into the two inferior hypogastric or pelvic plexuses." This is a very confusing description and the term "pelvic plexus" is used in a sense different altogether from that accepted by physiologists. The inferior mesenteric ganglion is stated to be less conspicuous and of less importance in man than in animals, whereas, in fact, it is merely less concentrated. The statement that in animals all the cell stations for "the sympathetic supply for the whole of the lower bowel and bladder" are situated in the inferior mesenteric ganglion is almost certainly erroneous. Langley showed that many of these cell stations are situated in ganglia of the pelvic plexuses. The functions of the sympathetic system are discussed in brief, reference being made to the controlling influence of a centre in the hypothalamic region.

In the second chapter, which comprises about one-half of the entire work, disorders of function of the circulatory system are dealt with. Many interesting observations are recorded. The authors have used sound methods of investigation following the lead given by Lewis, and write with authority and conviction. The

effects of various influences upon the peripheral circulation in health and disease are described and well illustrated by means of graphs. Methods used in differentiating between spasmodic and obliterative vascular diseases and the application of these tests to clinical work, more particularly in the selection of cases for operation, are fully discussed. The authors conclude that Raynaud's disease is due to some abnormality of the peripheral vessels, and not primarily to a disorderly action of the sympathetic nervous system. Various operations for sympathetic denervation of the extremities are described, and the indications and contraindications are clearly stated. The results of such operative interference are reviewed.

In the third chapter disorders of the visceral motor mechanism are discussed. The view that the sympathetic system actively antagonizes the para-sympathetic system is stressed, and is enlisted to explain various phenomena. This view will perhaps not be accorded universal acceptance. In dealing with the innervation of the colon (page 118), the authors state that Stopford has been able to show that the sacral nerve supply to this organ passes to it via the "presacral" nerve. It is known that in animals a few medullated fibres of unknown destination ascend in this way (Langley), but the overwhelming majority destined to reach the colon do not do so, and it is extremely unlikely that they do so in man. Unfortunately, no reference is given for Stopford's work. Various operations for the relief of constipation are described and results are discussed.

In the final chapter sympathectomy for pain is considered. Operations for the relief of dysmenorrhœa, painful affections of the bladder and kidney, and *angina pectoris* are described. The last section, dealing with *causalgia*, is excellent. It is suggested that the pain in this condition is caused, at least in part, by the abnormal state of the circulation in the affected limb, which state is secondary to the nerve lesion.

The authors are to be congratulated upon the production of this work, which is evidently the outcome of much painstaking investigation and wide reading. It will serve as a guide to practical surgeons, and as a stimulus to those who have a bent for the investigation of problems calling for solution.

Although certain points have been criticized here, these are few in number. On the other hand, the book contains a wealth of useful material, and is confidently recommended to the attention of readers. The volume is well printed and excellently illustrated.

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## SURGERY IN HISTORY.

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**A Short History of Surgery.** By SIR D'ARCY POWER, K.B.E., F.R.C.S.; 1933. London: John Bale, Sons and Danielsson. Crown 8vo., pp. 91. Price: 3s. 6d. net.

"A SHORT HISTORY OF SURGERY" is one of a series dealing with the history of various branches of medical science, and is written by D'Arcy Power, who is very well known to surgeons generally for his delightful sketches of some of the great English surgeons of the past. All surgeons must at times feel the urge to learn all that they can about the history of their craft, and this little book will not only serve to give any who read it an excellent basal knowledge of the chief stages in this history, but will undoubtedly whet their appetite for more. As the writer points out, it is now possible to see things in better perspective than at any other time; we can learn much from the older writers and, thanks to the interest that this subject is now arousing, these older works or their translations are relatively easy to come by. The book deals with surgery in the earliest historical time, the gradual development of surgical methods during the Middle Ages, the rise of the experimental method and its application to the healing art, the story of the final evolution of aseptic surgery, and finally with such aspects as American

surgery, nursing and dentistry. The above gives some idea of the scope of the work, and of the amount of interesting material which has been included in its eighty pages. It is arranged with a due sense of proportion, is singularly free from errors, is excellently—and in places charmingly—written in classical English, and should be read not only by all who are interested in the art of surgery, but by every medical student.

## TUMOURS AND THEIR SPREAD.

**Monograph of the Baker Institute of Medical Research. Number 2: The Spread of Tumours in the Human Body.** By R. A. WILLIS, M.D., B.S., D.Sc.; 1934. London: J. and A. Churchill. Demy 8vo., pp. 550, with illustrations. Price: 25s. net.

DR. WILLIS'S monograph is a most comprehensive study of the question of the various methods of spread of tumours. It is divided into two parts; the first is a general consideration of the problems of metastasis, and in the second the metastases occurring in the various organs of the body are considered.

In the first part the general principles, particularly the mechanism of the mode of spread, are dealt with. A great deal of original work has been performed and many of the author's conclusions are most illuminating. In addition the literature has been thoroughly reviewed and critically examined. It is refreshing to see an attack on such current views as retrograde embolism and implantation of tumours on epithelium-lined surfaces.

The second part is also well handled. The few situations of metastases that are not discussed, appear to have been omitted because they are considered in the first part. An example is peritoneum. The student of pathology, undergraduate or post-graduate, and more particularly the latter, will find many interesting, thought-provoking and previously unknown observations in these pages.

The use of heavy type in the text, to emphasize certain features, is an unnecessary and irritating feature of some pages. No uniformity of such usage has been practised, and the continued emphasis becomes wearisome and loses any (doubtful) value it may possess. The type of the heading also does not always give an idea of the relative importance of sections and sub-sections.

The illustrations are good, restrained and well produced. The paper is good and the type clear and satisfactory. An adequate index has been provided.

The volume is a valuable one, containing a wealth of material (323 cases personally examined by the writer) and an excellent review of the literature. There is no better exposition of the subject in the English language, and it is the result of careful, complete and intensive labour.

## CLINICAL SCIENCE.

**Clinical Science Incorporating Heart.** Edited by THOMAS LEWIS, M.D., F.R.S., aided in the selection of papers by T. R. ELLIOTT, M.D., F.R.S., R. T. GRANT, M.D., P. P. LAIDLAW, F.R.S., EDWARD MELLANBY, M.D., F.R.S., WILFRED TROTTER, M.S., F.R.S., and E. B. VERNEY, F.R.C.P. Volume I, Number 1. 1933. Shaw & Sons Ltd., London. Subscription price in England, 37s. 6d. per year.

ABOUT a quarter of a century ago, when cardiovascular physiology was making specially rapid advances, the first number of the journal *Heart* was issued, and until last year it successfully fulfilled its purpose as a journal devoted specially

to circulatory problems. The journal has now been incorporated in a new one, entitled *Clinical Science*, with a much wider scope, and the first issue published in July of last year includes papers covering a wide field of clinical investigation.

In an excellent paper on the activation of insulin, Himsworth presents evidence that insulin as prepared and as secreted by the pancreas is inactive and is activated in the tissues by an as yet unknown kinase. He has studied simultaneous blood sugar curves from capillary and venous blood after oral administration of glucose in normal subjects on high carbohydrate and high fat diets, and upon insulin depression curves obtained after the administration of small amounts of crystalline insulin in the same subjects.

Shortly after the commencement of hyperglycemia following the ingestion of glucose an S-shaped deviation has been demonstrated in the venous curves, which is formed by three consecutive variations in the arteriovenous difference. The third and largest variation has been termed the "venous step" and is held to indicate a rapid augmentation of active insulin in the tissues by an unknown activator. The injection of crystalline insulin is followed by a short latent period before there is any detectable action on the blood sugar, which is succeeded by a period in which insulin appears to act with increasing velocity. The duration of the latent period and the time taken for the blood sugar to reach its lowest point are independent of the amount of insulin injected. On a high carbohydrate diet the oral administration of glucose causes lower and less prolonged hyperglycemia and an earlier development of the "venous step". The injection of a standard dose of insulin has a shorter latent period and a more rapid rate of fall of blood sugar in subjects on high carbohydrate than on high fat diets. The administration of carbohydrate is therefore thought to stimulate the production of the unknown insulin kinase.

Lewis and Hess have investigated the mechanism of the production of skin pain, and conclude that (excluding dull pain) the skin gives rise to pain of only one quality, variations being caused by differences in duration. They lay stress on the development of a "susceptible state" resulting from injury. In this state the pain threshold to heat is lowered and venous congestion causes pain by stretching of the skin by engorgement of vessels. They attribute the "susceptible state" to the liberation of some tissue substance which acts on the pain nerve endings. Pain appearing as delayed after-effect when the skin is rubbed is thought to be due to further liberation of the same tissue substance and occlusion of the circulation may raise the concentration of the substance in damaged skin to the threshold level at which pain is produced. The excitation of pain nerve endings arising during actual stimulation is a wholly different process.

Wayne has studied two pure glucosides of digitalis, digoxin and *digitalinum verum*. He concludes that these are useful drugs in the treatment of auricular fibrillation, since they require no biological standardization and produce rapid effects. Digoxin can be given by the mouth and intravenously, but *digitalinum verum* can only be administered intravenously, since it has no effect on the ventricular rate when given by the mouth.

Pickering and Hess have contributed a series of observations on histamine headache caused in normal subjects by the intravenous injection of 0.1 milligramme of the acid phosphate. The headache probably arises from the *dura mater*. Histamine causes a fall in general blood pressure and a rise of cerebro-spinal fluid pressure due to cerebral vaso-dilatation. The headache develops as the pressure changes subside, and is relieved by raising the cerebro-spinal fluid pressure or by quickly lowering the arterial blood pressure. It is suggested therefore that it may be caused by stretching of sensitive structures lying close to the meningeal arteries.

Wayne and Laplace have contributed observations on the angina of effort. They have studied a series of eleven patients in whom exercise alone gave rise to anginal pain. The times of appearance and disappearance of pain in tests on these cases were constant for each. The pain was not related to changes in blood pressure, though there was some relation to the heart rate. The authors

investigated the influence of atropine, of pressure on the carotid sinus, of amyl nitrite, nitroglycerine, erythrol tetranitrate and euphyllin. They think that the beneficial action of nitrites is due to dilatation of the coronary vessels and not to the fall of blood pressure. Their results are consistent with the view that the pain in angina of effort is due to a relative myocardial ischæmia and not with the hypothesis that anginal pain arises from distension of the aorta.

Finally, Smirk has studied the excretion of urea and particularly of chloride in the blood of healthy subjects and in patients with renal disease following the oral administration of urea and of urea and potassium chloride. In normal subjects, after the ingestion of thirteen grammes of urea and three of potassium chloride, the urinary urea percentage of 2.0 or more and the chloride percentage of 0.8 is attained, but most patients with nephritis failed to attain this chloride percentage.

We congratulate the editor on the high standard of the contributions to the first number, and feel sure that the journal will play an important part in stimulating clinical research.

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### Editorial Notices.

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